

OCTOBER  
1962

PRICE 75 CENTS

# ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

NEW  
DIMENSIONS  
IN  
LIGHTING  
APPLICATION



A MCGRAW-HILL  
PUBLICATION

62ND YEAR

**n. c. gratelite offers all the advantages of a  
louver diffuser plus it's *NON-COMBUSTIBLE***



Guth N.C. (for Non-Combustible) Gratelite Louver Diffusers<sup>(1)</sup> are molded of non-combustible plastic—listed by Underwriters Laboratories, Inc. as NON-COMBUSTIBLE with a low 25 U.L. flamespread rating.

Supported by Guth Una-Tee System, N.C. Gratelite in overall electric ceilings can't fall out and cause panic. Also, building insurance rates may be substantially reduced with N.C. Gratelite Illuminated Ceilings.

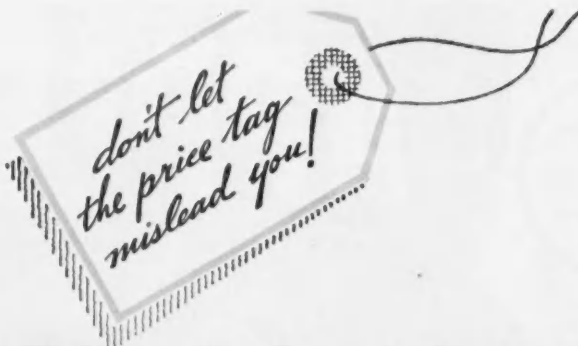
N.C. Gratelites feature built-in breathing action for complete flow of air through open  $\frac{3}{8}$ " cubes—fixtures and lamps operate cooler; dust, bugs and dirt drop through. Sprinkler systems, heating and air conditioning ducts can be mounted above open  $\frac{3}{8}$ " cubes. Supreme rigidity of N.C. Gratelites minimizes chance of buckling, sagging and warping in ceilings. Plus, N.C. Gratelite is non-electrostatic—repels dust and dirt for easier maintenance. N.C. plastic is light stabilized.

**write today for our N.C. GRATELITE brochure**

**THE EDWIN F. GUTH COMPANY, 2615 WASHINGTON BOULEVARD, ST. LOUIS 77, MISSOURI**

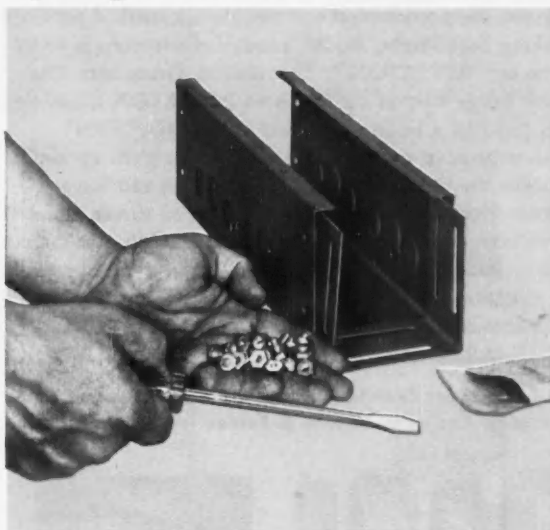
(1) LISTED BY U.L. ® U.S. PAT. NO. 2,745,001, CAN. PAT. NO. 538,245



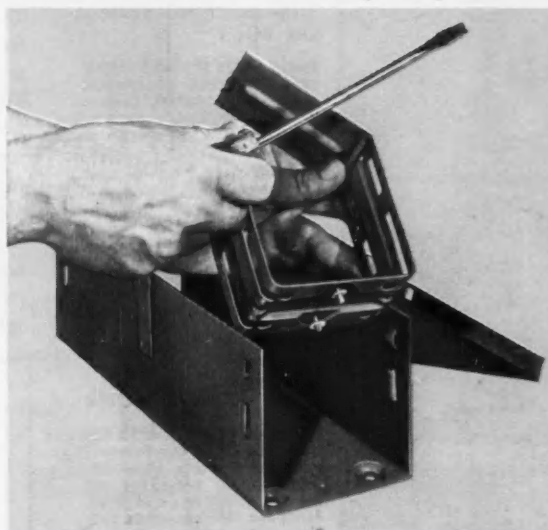


## Square D Lay-In Duct Actually Costs You Much Less than the So-Called Cheaper Wireways...

If you agree that **INSTALLATION TIME IS MONEY**...here's your proof—



It takes a lot of costly time to install and tighten from 6 to 12 screws or nuts and bolts. And that's exactly what you have to do with each length of poorly-designed wireway you install. Just multiply the number of minutes per connector by the total number of lengths on the average job. It adds up to a lot of expensive hours!



What a difference with Square D Lay-In Duct! Its rigid joint is made by simply slipping the connector in place and tightening 2 captive screws—it takes seconds! This one time-saving design feature alone has swung scores of contractors to Square D Lay-In Duct. There are additional design advantages and all of them make a lot of sense.

**Why not get all the facts before your next wireways job.  
Talk to your Square D Field Engineer or your Square D distributor  
Square D Company, Mercer Road, Lexington, Kentucky**

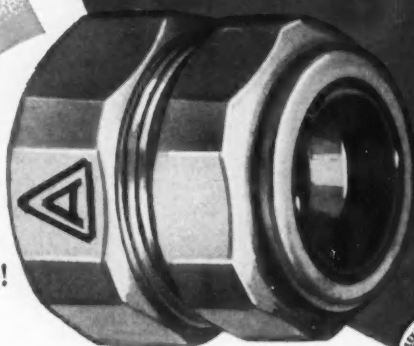


# SQUARE D COMPANY

**wherever electricity is distributed and controlled**

Another  
APPLETON  
"FIRST"

No Welding!  
No Crowding!  
No Wire Damage!  
No Shaking Loose!

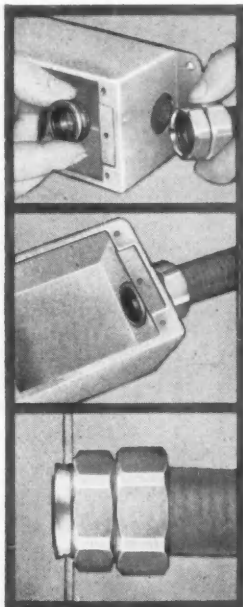


PATENT PENDING



# APPLETON®

## "STN" Sealite Connectors for Liquid-Tight, Flexible Conduit



### NEW LOCKING EDGE ON BODY

Special design of connector body locking edge bites into box wall and forms a constant, uniform seal . . . no welding . . . no lock-nut . . . always a positive ground!

### MORE WIRING ROOM

No projecting threads inside box. No weld. Wedge adapter hugs box wall almost flush when tightened. Forms "cold-weld" seal. No wrench needed inside box.

### NEW WEDGE ADAPTER

Male shank of unique APPLETON wedge adapter "finger tightens" into connector body. Flared surface of adapter wedges box wall against locking edge of body. Forms full 360° contact on both sides of box wall.

### New Insulated Throat



Acetate, insulating insert recessed into wedge adapter absolutely protects against wire damage . . . without reduction in throat diameter. Perfect for extreme vibration conditions. Nothing to come loose, deteriorate, crack, or break!

The fastest, most economical and trouble-free method yet devised for making liquid-tight, flexible conduit connections is yours with the new APPLETON "STN" Sealite Connectors. The exclusive wedge adapter used with all APPLETON liquid-tight fittings provides a lasting "cold-weld" seal. The "STN" provides a positive ground while the adapter pulls up almost flush inside the box to eliminate ragged edges and leave maximum wiring room. The acetate insulated throat protects wires without reduction of throat diameter! Only one wrench needed to install! Constant pressure of metal-to-metal seal resists vibration indefinitely! Full information and specifications available on request.

### Patented Brass Ferrule Assures a Positive Ground . . . Crimping Excludes Liquids & Fumes from Connection



### HERE'S HOW IT WORKS

Brass ferrule screws into spiralled inner wall of liquid-tight tubing forming continuous positive metal-to-metal ground. Compression nut and connector body crimps ferrule into outer neoprene wall to form permanent seal against liquids, fumes, and other foreign matter. Threaded shank of wedge adapter, when held in knockout hole, "finger tightens" into connector body. Locking edge on connector body bites into box wall when tightened (1/4 turn of wrench) and pulls adapter almost flush with inner box wall. A perfect installation every time . . . quick, easy, safe!

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Also  
Manufacturers  
of:



Explosion-Proof  
Fixtures



"EX" Series  
Flexible Couplings



Explosion-Proof  
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Explosion-Proof  
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# ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The  
Electrologist and Electrical Record      Established 1901

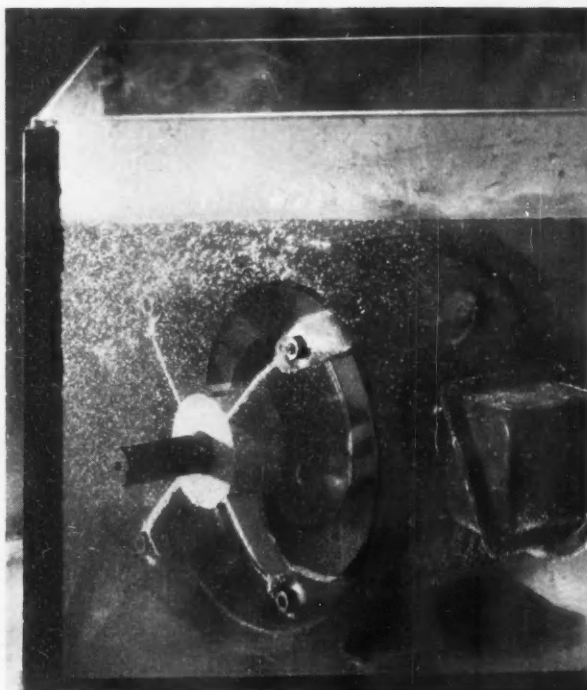
Published for electrical contractors, electrical departments  
in industry, engineers, consultants, inspectors and motor  
shops. Covering engineering, installation, repair, maintenance  
and management in the field of electrical construction  
and maintenance.

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Heating with infrared.	



# Upgrade motor enclosures



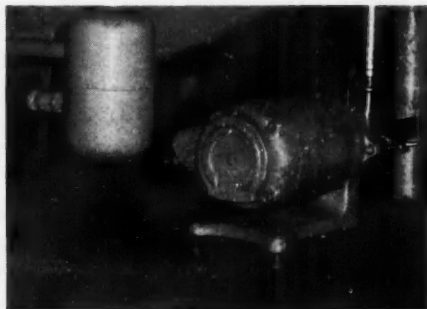
## **Specify Silastic RTV encapsulation for longer service life from motors**

For motors in *hot* water — in *cold* water — in *any* environment that causes frequent failure — encapsulation with Silastic® RTV silicone rubber offers superior protection for windings . . . multiplies motor life.

**Take a tip** from a midwest dairy. Subjected to daily equipment wash-downs, a milk-pump drive-motor failed monthly. Then the windings were encapsulated with Silastic RTV . . . and failures ended. That was nearly two years ago! Motor life was multiplied twenty times and more.

**Silastic RTV** is resilient — expands and contracts with the windings and laminations — won't crack or craze even during rapid thermal cycling. Silastic RTV remains rubbery over the wide temperature range of —70 to 180 C. Windings *stay sealed* in the protective jacket that's impervious to moisture, abrasive dusts and corrosive atmospheres.

**Specify encapsulation** with Silastic RTV to upgrade enclosures on your class A, B, F or H motors. This protection is available from nearly two hundred motor service shops throughout the nation. They identify themselves with the emblem at right.



For a list of these shops, and more information about Silastic RTV encapsulated motors, write Dow Corning Corporation, Dept. 3110, Midland, Michigan.



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# ELECTRICAL CONSTRUCTION AND MAINTENANCE

OCTOBER

1962 *continued*

## Electrical Hazards on Construction Projects . . . . . 136

By ROY WOODWORTH and ALFRED DOWDEN—Understanding a few important facts will enable construction gangs in the immediate vicinity of power equipment, temporary wiring, etc., to protect themselves against exposures to electric shocks.

## Use of Aluminum Conduit . . . . . 138

By DIXON LEWIS—Here are common questions and answers about practical job considerations in the installation of aluminum conduit in various environments.

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ELECTRICAL CONSTRUCTION and MAINTENANCE

OCTOBER 1962

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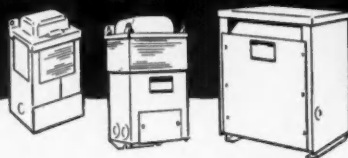
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# NEW General Electric Transformers



**FLOAT  
ON  
CUSHIONS**  
FOR QUIET OPERATION

UP TO 10 DB BELOW  
LATEST ASA STANDARDS



**THE SILENT TREATMENT** has been given all new QHT dry-types. For instance, the core and coil of new Type H units float on rubber cushions to isolate vibration within the transformer case. One of many reasons why new maximum sound levels are up to 10 decibels quieter than before. Result: no matter how low your ambient noise level is, there's a QHT transformer for the job. BE SURE YOUR TRANSFORMERS ARE QUIET . . . USE GENERAL ELECTRIC QHT TRANSFORMERS. Get all the facts from your nearby G-E Sales Office or distributor. Or write Section 411-22, General Electric Co., Schenectady 5, N. Y.

SOUND LEVELS IN DECIBELS\*

KVA	G-E Average	G-E Maximum	ASA Standard
0-9	37	40	40
10- 50	43	45	45
51-150	43	45	50
151-225	43	45	55
226-300	47	50	55
301-500	51	55	60

\* Measured per ASA-C89.1-1961-2.7.3

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

 **ACCENT**  
ON **VALUE**

# Sidelights

## LIGHTING PROGRESS

Associate Editor Berlon C. Cooper devotes a special report this month to a roundup of recent developments and practical examples of current lighting design and installation practice with emphasis on significant design details. This up-to-the-minute summary, "New Dimensions in Lighting Application," heads up our editorial feature section beginning on page 99.

## SWIMMING POOLS

Swimming pool electrical safety is the subject of two articles in this issue. In his editorial, page 97, Editor Stuart proposes a routine, daily, electrical safety test procedure for motel pools using 120-volt, wet-niche underwater lighting. Associate Editor John H. Watt follows with a detailed case study of a residential swimming pool on Long Island where quality and safety had top priority. "Around-the-Clock Safety Systems" begins on page 119.

## MODERNIZATION

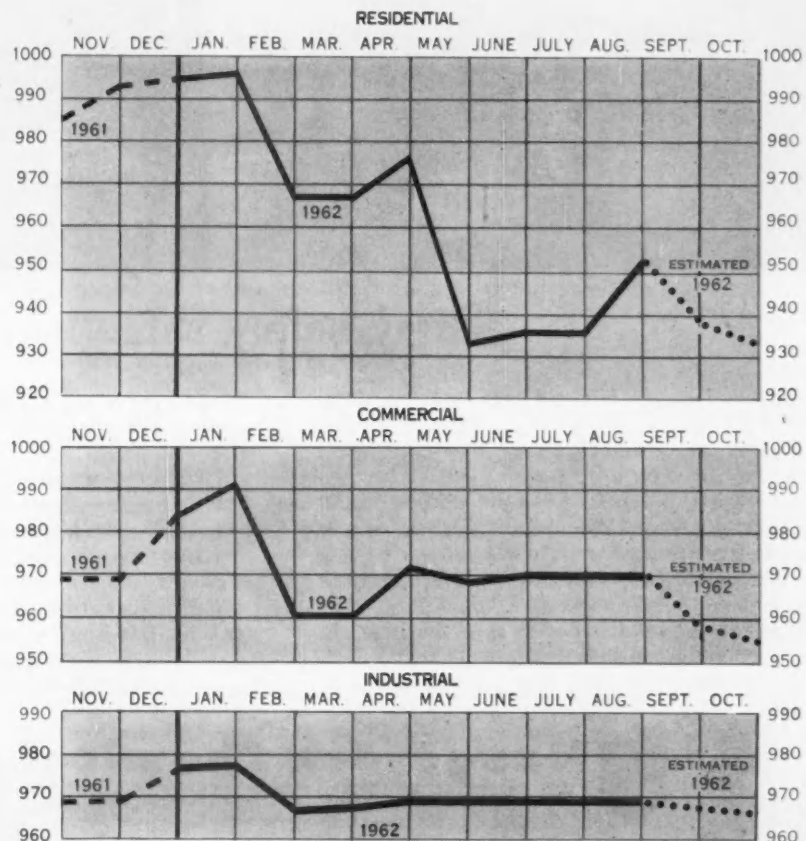
Electrical modernization plays an increasingly important role as U.S. industry up-dates facilities to beat the profit squeeze. A classic example is the recently completed project at the Alan Wood Steel Co., Conshohocken, Pa., where electrical construction included a new 30,000-kva outdoor substation plus a completely revamped primary distribution system. And of special interest is a modern 1000-kw silicon rectifier operating in parallel with ignitrons. Assistant Editor Robert J. Lawrie describes the project in "Steel Plant Electrical Modernization" beginning on page 122.

### ELECTRICAL MATERIALS COST INDEX

CHANGES IN THE COST OF ELECTRICAL MATERIALS FOR EACH OF THREE TYPICAL JOBS ARE SHOWN ON THESE THREE CHARTS.

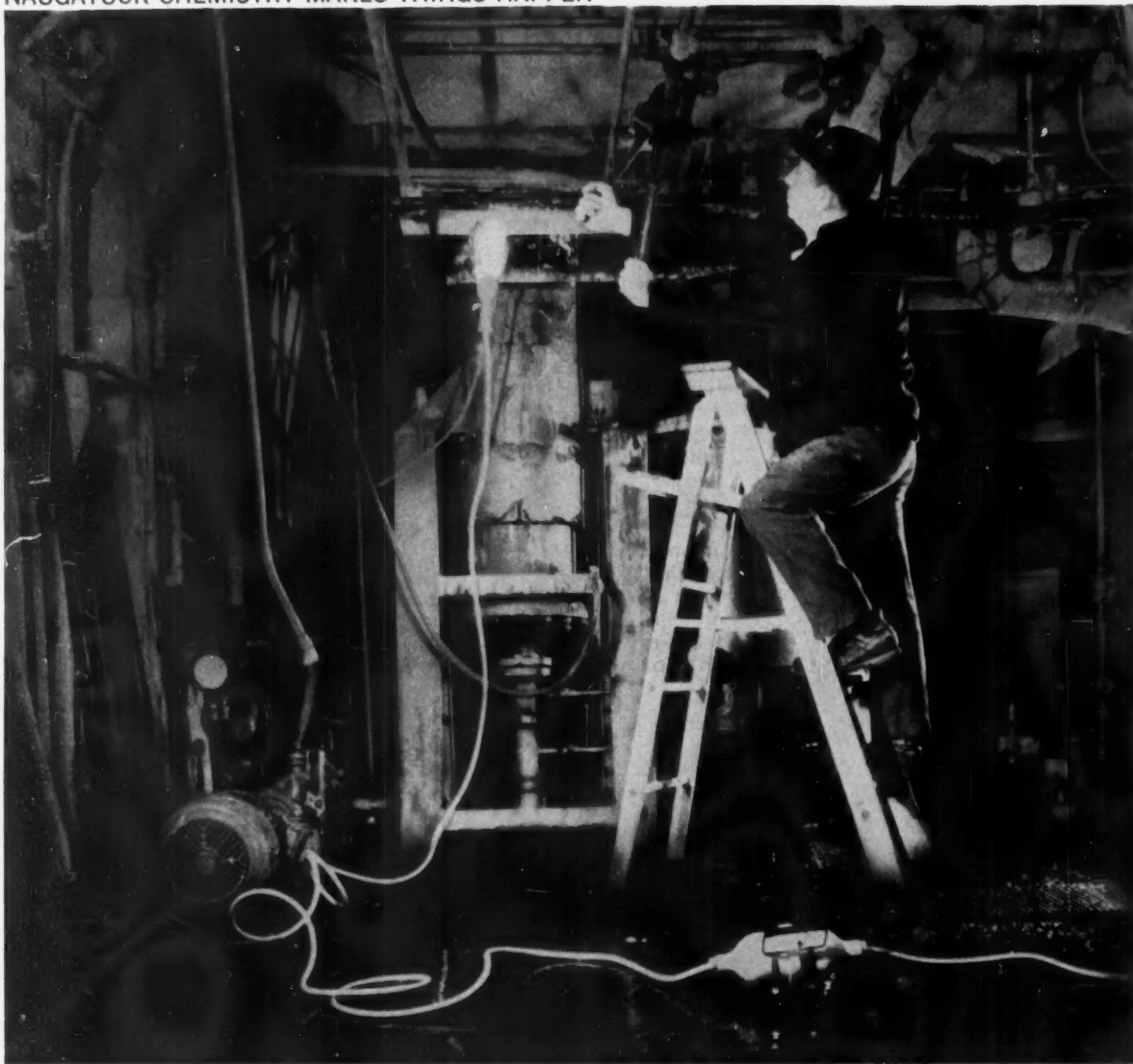
THE BASE (1000) REPRESENTS THE AVERAGE COST OF THE MATERIALS FOR THE YEAR 1960

THE MONTHLY INDEX POINTS SHOW THE VARIATIONS IN COST ON THE FIRST OF EACH MONTH.



SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

NAUGATUCK CHEMISTRY MAKES THINGS HAPPEN



MOLDED BY CENTRAL RUBBER CO., BELVIDERE, ILL.

## Safety, safety, safety!

**PARACRIL-OZO** Here's safety in a droplight such as you've never seen before...safety in appearance, safety in material, safety in design.

This new and patented LoVOLT droplight and extension cord by Daniel Woodhead Company\* has its own built-in transformer to reduce line voltage to a safe 6 volts at the outlet end, eliminating danger of serious shock even under hazardous working conditions.

Molded PARACRIL®-OZO covers form a watertight shield to protect the transformer and light socket units under the severest use conditions...gives the finest

possible protection against cutting, gouging, abrasion, weather, and the attack of ozone, oils, fats, acids, and other chemicals.

And PARACRIL-OZO's exceptional color retention allows a bright yellow cover that won't fade or darken, keeps these units visible even in close-to-total darkness.

Next time you need a rubber that's outstanding for its combination of toughness, color retention, and resistance to weather, oils, and chemicals, take a look at PARACRIL-OZO. You'll soon see why so many manufacturers have begun to enjoy the unique selling advantage only PARACRIL-OZO offers.

\*Chicago, Ill.



**Naugatuck Chemical**

Division of United States Rubber Company..Dept. 1034 PA Elm Street, Naugatuck, Conn.



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# Washington Report

OCTOBER • 1962

**Economic indicators continued mixed**, as the national economy coasts along at a record plateau. Gross national product in the third quarter was at an annual rate of about \$557 billion, only \$5 billion above the second quarter rate. But total national output for all 1962 seems sure to lag behind totals for the year which were forecast last January by about \$12 billion.

Here are some of the recent statistics, but it will be noted that these figures fail to indicate any major changes in the economy:

- **Industrial output** in August held at its record level of 119% (of the 1957 average). The index for August 1961 was 113%.

- **Personal income** in August rose to another record of \$442.8 billion, seasonally adjusted annual rate. This was \$900 million above the July record, but was the smallest monthly rise since January.

- **Retail sales** dropped 0.5% in August from the July record, to \$19.6 billion, seasonally adjusted. This was 8% ahead of retail volume in August 1961.

- **Capital spending** plans showed no change in August, as the SEC-Dept. of Commerce survey put 1962 outlays at \$37.2 billion, same as in February and May surveys.

**Construction spending in August held steady** at the July annual rate of \$62.2 billion, seasonally adjusted, but was up 7% from the August 1961 rate. The year's record was set in June, with a seasonally adjusted annual rate of \$62.7 billion.

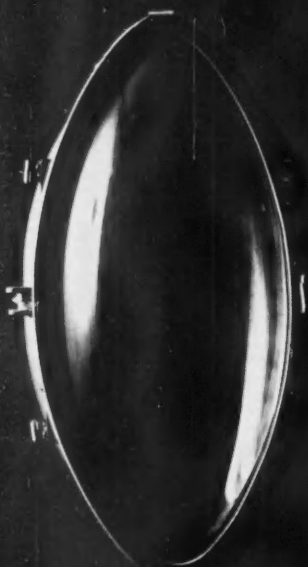
Actual construction spending in August was \$5.8 billion, up fractionally from July. Private expenditures were \$4,009 million down from \$4,066 million in July, which was attributed to a drop in the spending rate for homes and other types of construction. Public expenditures for new construction were \$1,774 million, up from \$1,688 million in July, which offset the decline in private expenditures. Spending picked up, however, for private commercial buildings and utility projects. The Dept. of Commerce's mid-year forecast of \$60 billion for new construction for 1962 now seems assured.

**Housing starts rose in August** for the second month in a row. The number of starts in August totaled 147,100 as compared with 137,600 starts in July and 130,100 starts in August 1961. However, actual outlays for residential construction put in place declined from a seasonally adjusted annual rate of \$25.8 billion in July, to \$25.3 billion in August. The August starts, on a seasonally adjusted annual rate, were up 5% from the July annual rate, and up 15% from the August 1961 annual rate.

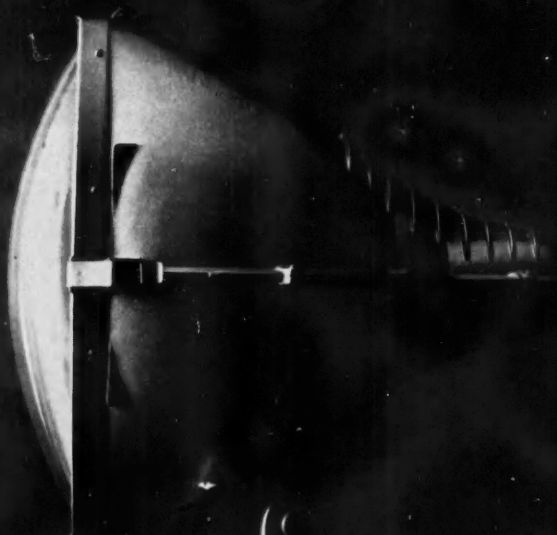
The biggest jump in total August starts was in the midwest, where seasonally adjusted initial construction rose 20%. Starts increased 5% in the northeast and 7% in the south but declined 7% in the west.

Housing starts for the first seven months of 1962 totaled 840,000, which was 13% ahead of the same period of last year.

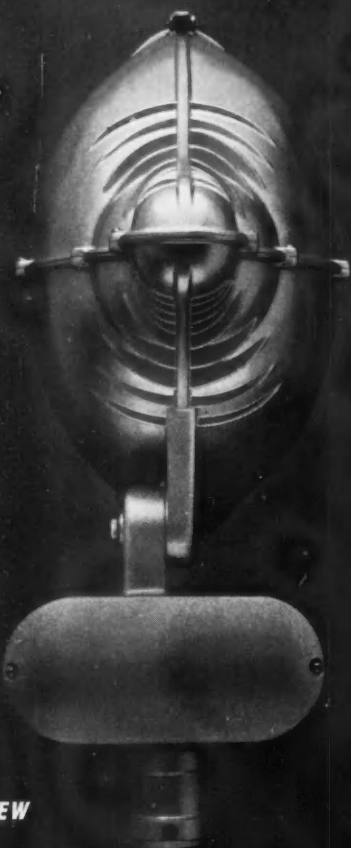
**Output of electricity totaled 17.3 billion kwhr, a new record**, during the fourth week of August, which was again off 11.8% from the similar 1961 period. The gain was attributed largely to the increased use of electricity for air conditioning, especially in the southeast, south central and west central areas where warm weather prevailed.



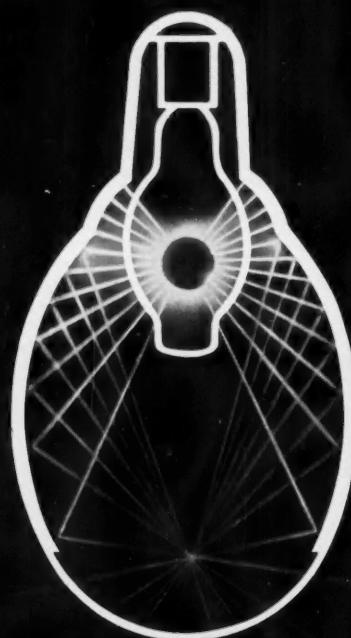
**FRONT VIEW**



**SIDE VIEW**



**REAR VIEW**



**PHOTO-DIAGRAM OF HORIZONTAL CROSS SECTION  
SHOWS WIDE LATERAL LIGHT DISTRIBUTION**



## This narrow shape produces the widest usable beam of any floodlight

### Revolutionary new "Cat's-Eye" Floodlight\* delivers widest horizontal beam plus controlled vertical distribution

The 400-watt mercury floodlight at the left may well be one of the most important (and exciting) advances in outdoor lighting since the introduction of the mercury lamp. Though narrow, it produces the widest usable beam of any floodlight. Our engineers explain that this revolutionary design is simply the most efficient way to achieve an extremely wide lateral beam spread while maintaining a carefully controlled vertical distribution.

Prior to the invention of the CAT'S-EYE, a light pattern of wide lateral and controlled vertical distribution could be obtained only with a point source in combination with a Fresnel lens. This new Revere floodlight achieves such distribution with high utilization by means of a unique combination of elliptical and parabolic reflector contours.

Beam spreads and efficiencies are given in the table below. Notice that efficiency figures are *beam efficiencies* and that changes in the vertical distribution may be achieved without appreciably affecting the wide lateral distribution.

400-Watt Mercury Lamp	Horizontal Beam Spread	Vertical Beam Spread	Beam Efficiency
Clear	158°	39°	57%
Phosphor-Coated	164°	80°	61%

The controlled beam of the CAT'S-EYE puts more light where you want it and makes possible efficient, economical lighting of parking lots, sports areas, loading ramps, and building fronts. Now you can light wide areas with fewer floodlights and attain higher intensities than with conventional units.

We expect that there may be questions about the ability of so narrow a floodlight to produce such a wide beam. To answer these questions our representatives will welcome the op-

portunity to supply photometric data and to arrange a demonstration that will let this remarkable luminaire speak for itself.

The handsome CAT'S-EYE is internally wired with no cords or wires exposed to view. It is sturdy and weatherproof and is designed for long, trouble-free service and easy installation. A degree-marked fitter and built-in sights assure accurate aiming. The narrow shape permits compact mounting of the floodlights in multiple installations, and accessories are available for pole-top, cross-arm, pipe, or wall mounting.

A combination fitter-housing encloses a choice of constant-wattage or reactor-type ballasts for common primary voltages. A fitter without the housing and integral transformer is used with remote ballasts.

Ask your Revere representative for more information on how you can widen your outdoor lighting horizons with the CAT'S-EYE, or send for your copy of Bulletin No. 100-49.

**FRONT VIEW** of Revere CAT'S-EYE illustrates slender, upright contour. Unique shape results from use of reflector with elliptical horizontal cross section that gives widest usable horizontal beam of any floodlight. **SIDE VIEW** shows parabolic contour of luminaire's vertical cross section that produces controlled vertical beam spread. **REAR VIEW** shows combination fitter-housing that encloses transformer for mercury lamp. Fitter without housing available for use with remote ballast. **PHOTO-DIAGRAM** of top view shows wide horizontal light distribution. Outline drawing of Revere CAT'S-EYE is superimposed on photograph of reflector's horizontal cross section. (Note: Special light source is here surrounded by slotted shield to produce ray trace that represents light flux in this laboratory demonstration.) Light control is achieved solely by the compound elliptical reflector. Special heat-resistant convex lens is contoured to prevent internal reflections and to provide maximum light transmission. Lens in its gasketed, hinged frame provides weathertight cover.

\*Patent applied for.

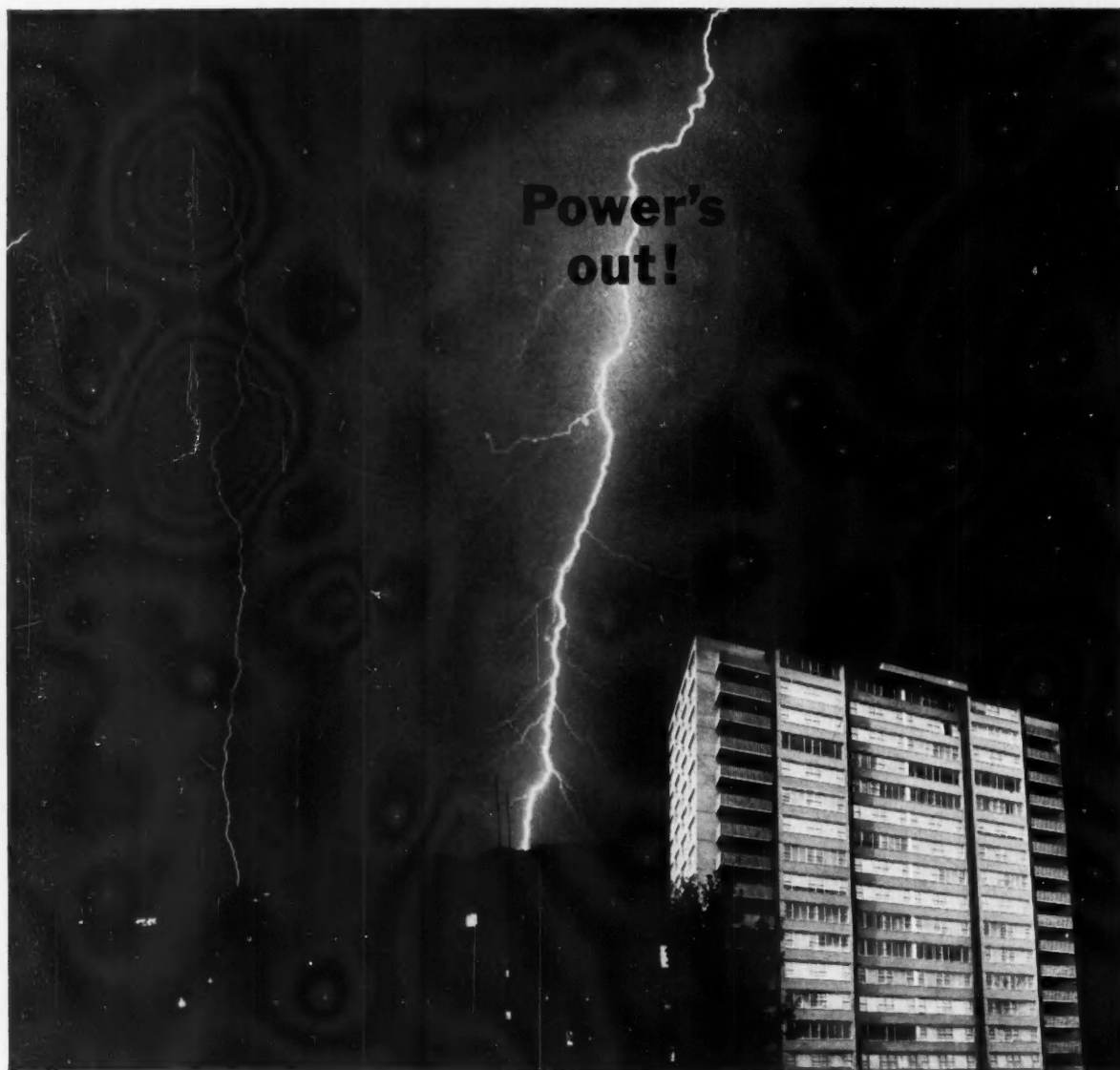
RVR-2-216

# Revere®

## OUTDOOR LIGHTING

REVERE ELECTRIC MFG. CO.

7420 Lehigh, Chicago 48 (Niles), Illinois  
TELEPHONES: Area Code 312, Niles 7-6060;  
Chicago, Spring 4-1200. TELEGRAMS: WUX Niles



## ...but not at the Park Towers

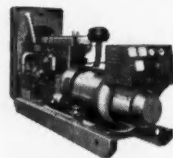
Off goes the power! On goes the Kohler Stand-by Electric Plant at the Park Towers Apartments in Columbus, Ohio.

The tenants appreciate this emergency service. The owners appreciate their 30 KW Kohler Electric Plant that takes over—automatically—when normal power fails—providing emergency power for elevators and boiler room—lighting for stairwells, garage, halls—vital areas.

Stand-by power is a potent persuader in getting—and keeping—tenants. Is *stand-by* a big enough word in your power planning?

Versatile Kohler Electric Plants range from 500 to 115,000 watts. Gasoline or Diesel, air or liquid-cooled, stand-by and sole power. For more information, write to Kohler Co., Kohler, Wisconsin, Dept. EP-509. (Engineers: see Sweet's Architectural File and Sweet's Light Construction File.)

Park Towers Apartments, 1620 E. Broad St., Columbus, O.  
Architect: Nowicki & Pailla, Philadelphia, Pa.  
General Contractor: E. J. Frankel, Philadelphia, Pa.  
Electrical Engineer: Robert S. Curl & Associates, Columbus, O.  
Electrical Contractor: Gustave Hirsch Organization, Inc., Columbus, O.



Kohler  
Electric Plants,  
500 to 115,000  
watts

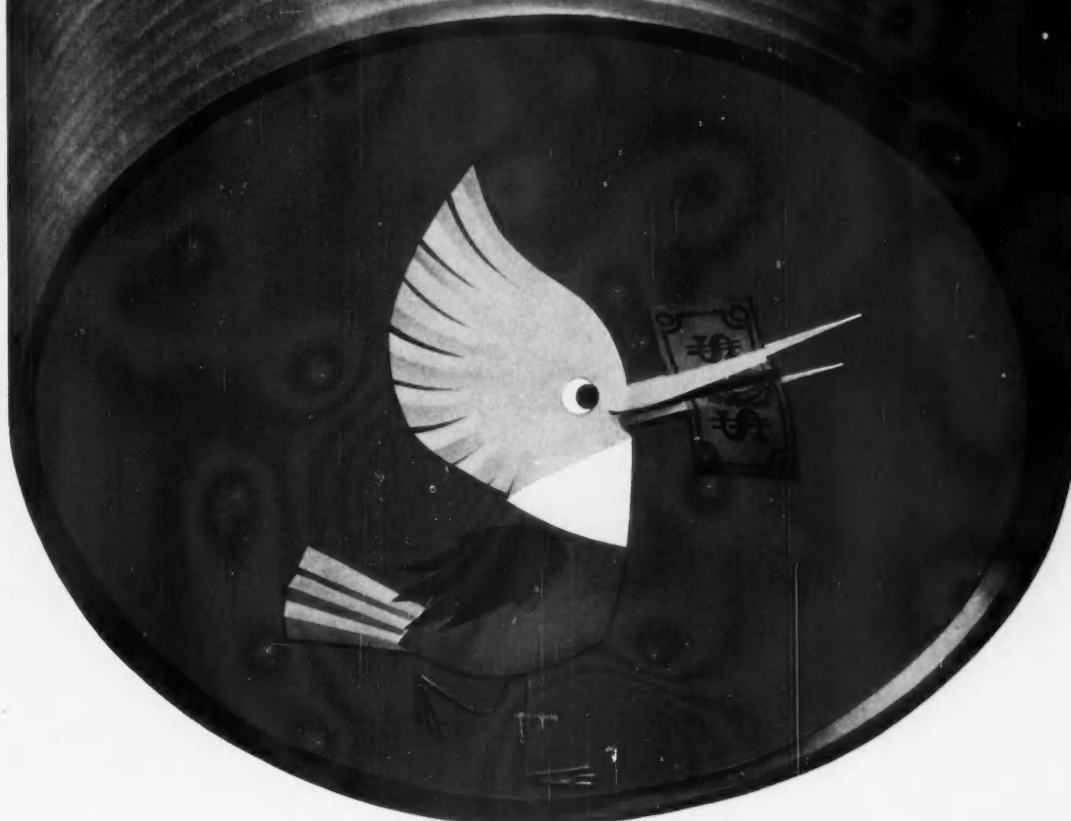
## KOHLER OF KOHLER

Kohler Co., Established 1873 • Kohler, Wis.

ENAMELED IRON AND VITREOUS CHINA PLUMBING FIXTURES • ALL-BRASS FITTINGS • ELECTRIC PLANTS • AIR-COOLED ENGINES • PRECISION CONTROLS



●●●● KAISER ●●●●  
**KINGFISHER\***  
 ALUMINUM CONDUIT  
 ●●●●●●●●●●●●●●●●●●●●



**LOOK FOR THE PURPLE LINING THAT MEANS TWO-WAY SAVINGS**

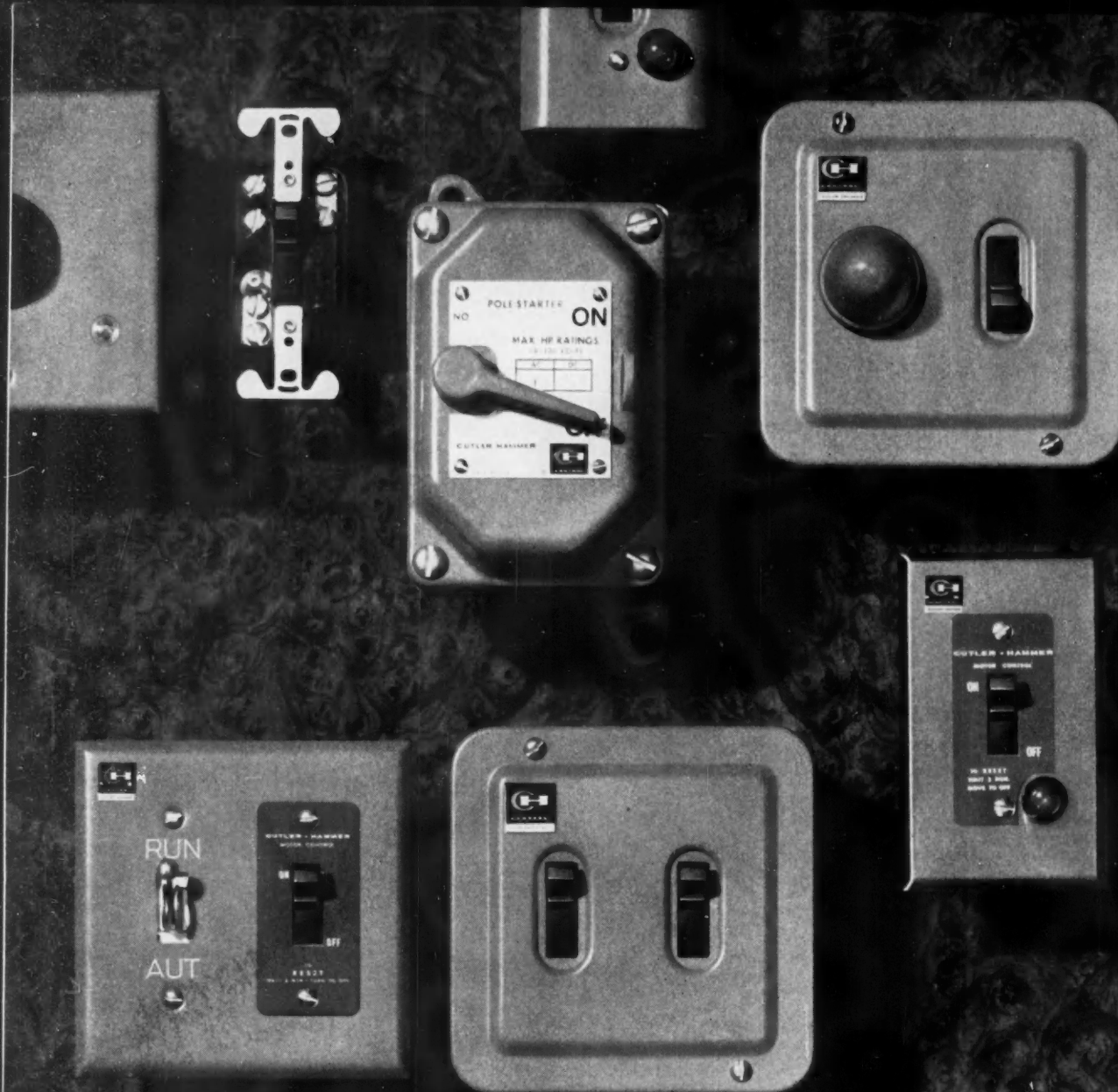
1. **FASTER, EASIER PULLS:** the purple lining means Kaiser KINGFISHER is the only conduit with K-40 silicone . . . the specially developed smooth, hard inner lining that lets cables slip past bends up to 61% easier!†
  2. **KAISER ALUMINUM'S EXTRAS:** this exclusive purple lining also tells you that Kaiser KINGFISHER is the only conduit that saves time and money with: aluminum's light weight, easy threading, uniform bending, and high strength forged couplings.
- Only competitively priced Kaiser KINGFISHER has all the advantages of aluminum plus slick K-40 silicone lining. Cut installation costs on your jobs: look for the purple lining and get two-way savings . . . from your authorized Kaiser KINGFISHER Distributor.

† Pull required after fourth bend in standard test comparing other lined and unlined conduits including steel: using 3 #2RHW cables in 1¼" conduit.

\* Trademark of Kaiser Aluminum & Chemical Corporation.

**KAISER**  **ALUMINUM**

Watch "Kaiser Presents the Lloyd Bridges Show" weekly, CBS-TV Network



## Complete line! Now with NEW 2-speed

**Immediately available from stock,** Cutler-Hammer Manual Starters will stop, start and protect all types of fractional horsepower A-c or D-c motors on all types of electrically driven equipment. To meet your needs completely, new key and lever operated starters have been added.

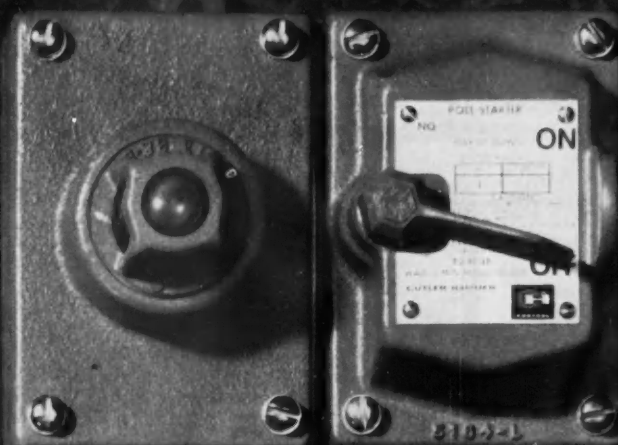
Also added to the new line is another Cutler-

Hammer exclusive: the only two-speed starter which provides separate overload coils for high and low speed positions specifically fitted to the amperage involved at either speed.

Call your Cutler-Hammer sales office or distributor for a demonstration. Or, write for Bulletin LJ-86-V241.



NEW from  
CUTLER-HAMMER



*Above, new 2-speed and key and lever operated MANUAL STARTERS*

## knob-operated manual starter

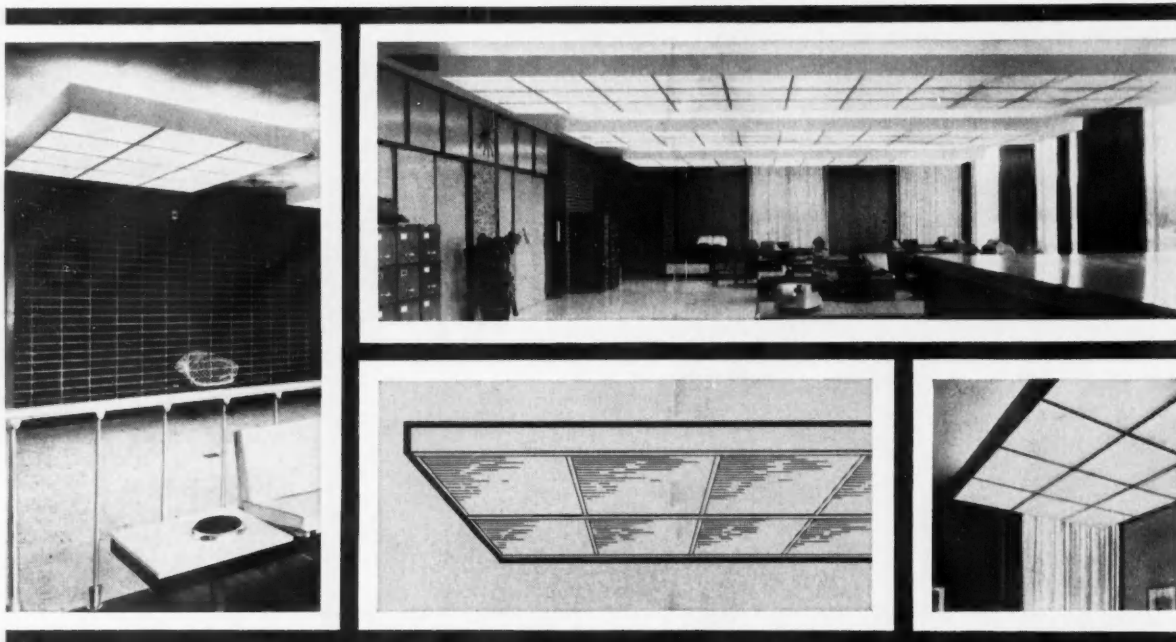
WHAT'S NEW? ASK...

**CUTLER-HAMMER**

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer, Canada, Ltd.; Cutler-Hammer, Mexicana, S. A.



## LPI Panelaire series offers design flexibility, visual comfort and high-level lighting



Here's a refreshing way for lighting specifiers to depart from conventional row-type fluorescent lighting installations. The Panelaire series utilizes large floating panels of light to achieve high levels of illumination while maintaining effective control of direct and reflected glare. □ Recent photometric measurements have shown that the widely accepted Panelaire complies with the brightness limitations of the "Scissors Curve" as recommended by the Illuminating Engineering Society. In addition, the large area of the light source minimizes reflected glare. □ The panels are designed for pendant mounting in square or rectangular patterns on a two-foot module. The bold, massive lines of the Panelaire harmonize with contemporary architectural designs and with existing ceiling structural elements in the case of relighting projects. With its wide choice of diffusers, the series is well suited for stores, offices, banks, foyers, lobbies, and high-bay fluorescent lighting. □ Please write LPI for complete Panelaire technical data.

LPI-2-212

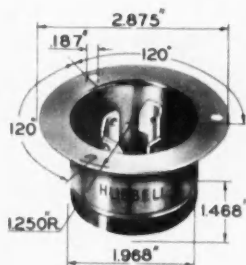
# LPI

## FLUORESCENT LIGHTING

Lighting Products Inc., Highland Park, Illinois



## Handles Bigger Loads in Less Space SUPER "TWIST-LOCK" Flanged Inlets and Outlets



Super "Twist-Lock" Flanged Inlets and Outlets are far more compact than conventional units which are rated at only 20 amperes. This means space saving economies in panel board or equipment design, as well as savings in weight.

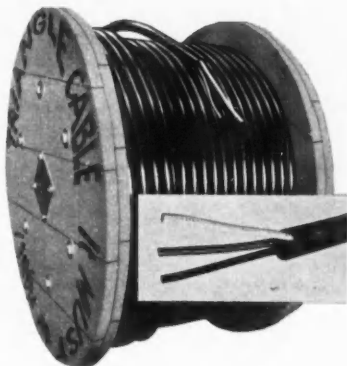
Super "Twist-Lock" Flanged Outlets and Inlets in polarized grounded or ungrounded models are available in 10, 20 and 30 ampere ratings for 2, 3, 4 or 5 wire circuits.

Send for new 24-page engineering brochure describing the complete, "Twist-Lock" line.

Circle 1 on the Graybar postcard.

**HARVEY HUBBELL, INC.**

## NEW Pre-Assembled Underground Electrical Circuit Combines Conductors and Plastic Duct



This new concept in underground distribution of electrical power combines conductors and protective duct in a single, pre-assembled unit. The "TRIANGLE UNIT TYPE DUCT-CABLE SYSTEM" greatly cuts the cost of transporting and installing materials for underground street and highway lighting distribution systems.

The Triangle System is shipped in single, long lengths of coilaible plastic duct on reels. The system thus reduces transportation costs, eliminates assembly of conductors and duct at the site and can be unreelcd continuously, without fittings, into a narrow trench.

Send for detailed information.

Circle 2 on the Graybar postcard. \*Pat. Applied For

**TRIANGLE CONDUIT & CABLE CO., INC.**

A Time-saving Guide to New Products and Uses...

# Graybar's IDEA BOOK #7

• Must reading for those who specify, recommend, design, install, maintain or purchase electrical equipment.



Whatever your electrical needs—call Graybar!

## NATIONAL ELECTRIC makes SURFACE WIRING easy to install, easy on the eyes, easy on cost

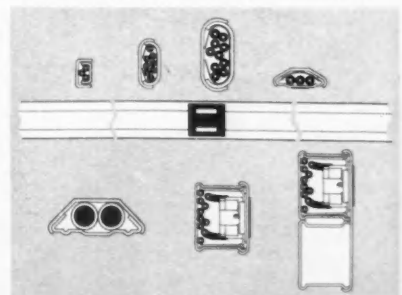
Metal molding, Surfaceduct, Twinduct, Florduct, Plug-in Strip... National makes them all. And you can order them all from Graybar. Compare...

**Installation.** NE base-and-cap construction makes it fast and easy. Just fasten the base, lay in the wires and snap on the cap. No fishing. Fewer fittings. All types interconnect.

**Looks.** Minimum cross section, since there's no fishing space required. Low contour makes good appearance.

**Cost.** Fast installation... saves money on every job. Fewer fittings to buy. Send for detailed product information.

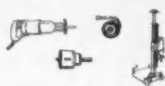
Circle 3 on the Graybar postcard.



**NATIONAL ELECTRIC DIVISION  
H. K. PORTER COMPANY, INC.**



Maintenance Tools



Alteration Tools

**Make Graybar your prime source**

**for top performance tools...**

## EDWARDS' PSA SWITCHES

Precision Snap Action (PSA) switches are now available in whatever quantity you require from your nearest Graybar house. Available with five different actuators and either solder lug or screw terminals, these U.L. listed, miniature size switches meet most industrial applications. For complete detailed information including dimensions ask for the new well-illustrated product bulletin.

Circle number 4 on Graybar postcard.

**EDWARDS COMPANY, INC.**



FLEXIBLE LEVER

RIGID LEVER

RIGID ROLLER LEVER

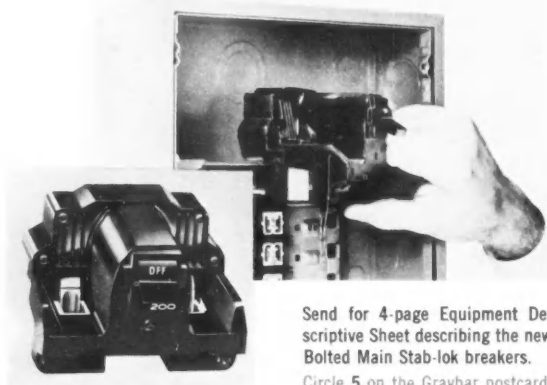
## NEW-MAGIC MAIN BREAKERS

### BOLTED CONSTRUCTION

Require no mounting space on panel bus bars.

Eliminates need to stock expensive main disconnect panels—breakers bolt into main lug area in load center panels.

CATALOG NO.	AMPERES
2B 125	125A
2B 150	150A
2B 200	200A



Send for 4-page Equipment Descriptive Sheet describing the new Bolted Main Stab-lok breakers.

Circle 5 on the Graybar postcard.

**FEDERAL PACIFIC ELECTRIC COMPANY**



## SAVE UP TO 30% WITH ALUMINUM BUILDING WIRE

### LOWER COST

Initial material costs of aluminum building wire are substantially lower than copper. In material costs alone, savings of 20 to 30% can be obtained with the use of aluminum building wire.

### EASIER HANDLING

Insulated aluminum cables are 1/2 to 1/3 the weight of electrically equivalent copper cables. This means easier handling, less abrasive damage, less worker fatigue... all resulting in lower installation costs.

### AVAILABILITY

Available in sizes #6AWG and larger in types RHW, THW, TW, USE and UF. Service entrance cable is available in both neoprene and braid jacketed types.

Manufacturers of aluminum and copper insulated cables and rigid aluminum conduit.

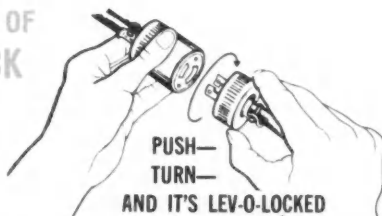
Send for full details.

Circle number 6 on the Graybar postcard.

**KAISER ALUMINUM & CHEMICAL SALES, INC.**

## A FULL LINE OF LEV-O-LOCK DEVICES

that assures uninterrupted power flow



**AND IT'S LEV-O-LOCKED**

Lev-o-Lock Specification Grade devices provide safe, dependable connections under the severest conditions of vibration, motion or accidental pull-out. Leviton offers a full line that includes 2, 3, and 4-wire types in 10, 15, 20 and 30 Amp ratings, all of which are interchangeable with other locking devices on the market today. All devices in this line are U.L. listed and include such outstanding features as phosphor bronze double-wipe contacts, heavy sectioned construction and corrosion resistant plating on all exposed steel parts.

Send for Leviton's latest 16-page detailed catalog which includes the complete Leviton Lev-o-Lock Line and contains over 600 other wiring devices for Industrial, Commercial and Residential buildings.

Circle number 7 on the Graybar postcard.

**LEVITON MANUFACTURING COMPANY**



S181

## NOW... FROM THOMAS INDUSTRIES A NEW ECONOMICAL INCANDESCENT ELECTRONIC DIMMER

M-6501. This newest member of the growing family of TI electronic dimmers installs in minutes in a regular switch box. Permits smooth, variable control to mid-range, then full brightness. 500 watt capacity, 120 volts, 60 cycle. No flicker... no interference.

Learn more about the complete line of Thomas Industries dimming equipment with SCR, both incandescent and fluorescent. Send for colorful 4-page dimmer brochure.

Circle number 8 on the Graybar postcard.

**THOMAS INDUSTRIES**



## Is Concrete Anchor Setting Your Problem? THE NEW B&D HEAVY-DUTY HAMMER-DRILL SOLVES IT!



Here is the latest addition to Black & Decker's line of long-life, versatile, time-saving tools—a hammer and a drill all in one tool. Drills perfectly in a wide variety of materials.

Ideal for rapid installation of 1/4" through 1/2" bolt size, flush stud, tie wire, rod hanger, lead plug and other types of expansion shells and anchors.

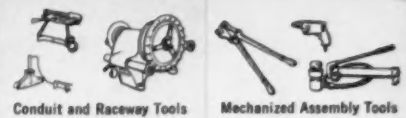
Exclusive B&D Shifting Mechanism: Just a turn of the collar converts action from direct drilling—for steel, wood, etc., to percussion drilling in concrete, porcelain, brick tile, etc. Lightweight, compact, well-balanced.

Send for well-illustrated spec sheet. Circle 9 on the Graybar postcard.

**THE BLACK & DECKER MANUFACTURING COMPANY**

**You'll find all the quality tools**

**you need to speed the job!**



Conduit and Raceway Tools

Mechanized Assembly Tools

### RIDGID CONDUIT BENDERS

feature Extra-Long Handle  
Sockets to Minimize Breakage!



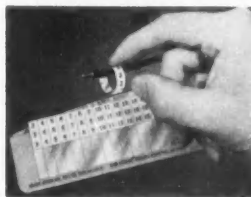
Thin Wall  
Conduit Benders  
3 Sizes for  
1/2", 3/4" and 1"

Hickey-Type,  
Heavy Wall Conduit Benders  
2 Sizes for  
1/2" to 1 1/4"

RIDGID Conduit Benders have handle threads at bottom of extra-long supporting socket for minimal handle breakage. Finish is exceptionally smooth. Bending grooves conform to Standard Code Radii. Side walls grip conduit snugly . . . minimize distortion. Easy-to-see arrows give accurate guide for back-to-back and stub bends.

Send for illustrated spec. sheet.  
Circle 10 on the Graybar postcard.  
**THE RIDGE TOOL COMPANY**

### DIRT OR OIL PROBLEM? Specify Brady Perma- Shield Wire Markers!



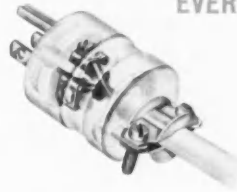
Here's a Wire Marker with built-on protection. It combines printed legend (numbers, letters, symbols) with a glass clear cover of indestructible Mylar. Legend is protected permanently from oil, grease, dirt, grit and abrasion. Ideal for motors, generators, transformers, outdoor equipment. Marker and cover are self-sticking. Two sizes. Over 700 different legends. Send for free Perma-Shield Wire Marker and new 4-page descriptive folder showing sizes, uses and ordering information for Perma-Shield Wire Markers and Write-On-Labels.

Circle 11 on the Graybar postcard.

\*DuPont's Reg. T.M.

**W. H. BRADY CO.**

### SAFEST PLUG CAP EVER!



Here's complete safety with the back-wired, dead-front "SAFETY YELLOW" SAFEWAY Plug Cap. Simplified method of wiring, with unbreakable polycarbonate plastic insert, eliminates hazards of lost insulators, exposed wiring.

Oil-proof NEOTEX cover accommodates cord sizes from 18/2 SJ to 12/3 S. Corrosion-resistant stainless steel cord grip assembly.

AND—There's now a SAFEWAY Plug Cap in every standard configuration! Send for fact-filled bulletin describing complete line of Safeway Back-Wired Plug Caps.

Circle No. 12 on the Graybar postcard.

**DANIEL WOODHEAD CO.**

### C-L-P\* CROSS-LINKED POLYETHYLENE CABLES BY SIMPLEX



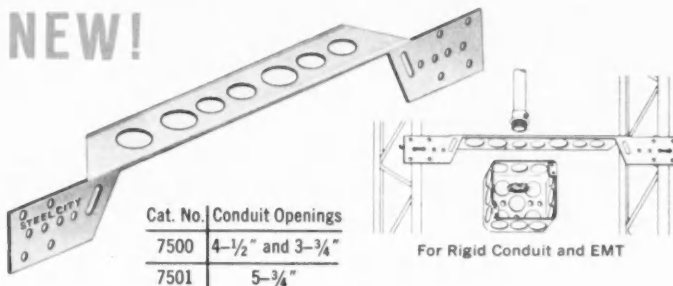
For voltages up to and including 15 KV, C-L-P\* cables offer high ampacities (conductor temp. rating 90°) light weight, easy handling and low cost. C-L-P\* combines best properties of rubber and thermoplastic and is suitable for use in ducts, conduit, trays and for aerial, submarine or direct burial applications.

Send for descriptive literature.  
Circle 13 on the Graybar postcard.

\*TRADE MARK.

**SIMPLEX WIRE & CABLE CO.**

## NEW!



Cat. No.	Conduit Openings
7500	4-1/2" and 3-3/4"
7501	5-3/4"

For Rigid Conduit and EMT

### BOX AND CONDUIT SUPPORT BRACKET FOR FAST MOUNTING ON METAL STUDDING

New 16 ga. galvanized steel mounting bracket securely mounts 1 1/2-inch deep outlet boxes flush with studding or joists, allowing selection of plaster ring depth to suit requirements. Two-inch deep switch boxes are mounted by simply inverting the bracket. Boxes, when mounted securely, cannot turn laterally and are aligned for finish plaster ring.

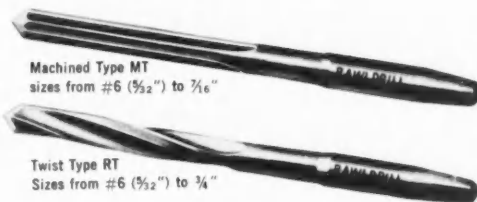
For full details send for free bulletin.

Circle 14 on the Graybar postcard.

**STEEL CITY ELECTRIC COMPANY**

### FOR DRILLING HOLES IN MASONRY

... these drills are the most dependable  
and least expensive



Machined Type MT  
sizes from #6 (5/32") to 3/16"

Twist Type RT  
Sizes from #6 (5/32") to 3/16"

Rawldrills are the most advanced masonry drills available, yet these three-point steel percussion drills are both inexpensive and durable. In the 5/32" to 3/16" diameters, they offer the most economical and dependable method for drilling a hole in masonry. Their rugged construction assures excellent results with either type in even the toughest kinds of masonry.

Send for a new 58-page pocket-sized "Handbook of Masonry Anchoring." The handbook contains complete information on drill diameters, holding powers, applications, as well as helpful hints on drilling in masonry.

Circle 15 on the Graybar postcard.

**THE RAWLPLUG COMPANY, INC.**

### Buss LOW-PEAK Fuses an Outstanding Advancement in Protective Devices



Buss LOW-PEAK fuses can completely revolutionize the protection of the entire electrical system.

Protect Circuits, Motors, Controllers. Switches whether fault current is 1,000 amps., 100,000 or 200,000 amps.

Prevent damage to Panelboards, Controllers or other circuit components. Let-thru currents are limited to exceptionally low values.

Can be easily coordinated into a selective system—to limit fault outages to circuit of origin.

Prevent waste of time and money—because long time-lag keeps them from opening needlessly on harmless overloads.

Fuses fit standard switches and panelboards. Available from 1/10 to 600 amperes in both 250 and 600 volt range.

Remain safe throughout the years without maintenance or recalibration.

Send for well-illustrated 10-page bulletin providing charts, tables and helpful information on proper selection of fuses for the protection of circuits and equipment.

Circle number 16 on the Graybar postcard.

**BUSSMANN MFG. DIVISION • McGraw-Edison Company**



Inside Salesman



Specialist

*Graybar Service includes: Complete catalog, ordering, scheduling information—unbiased recommendations—systems planning and design...*

## SMALLEST ELECTRIC DRILL in the WORLD

... And it's Rated for Industrial Use!

HALF THE SIZE is only half the story of Thor's new E-100 "COMPACT" 1/4" Electric Drill... sensational new motor design features solid stator—guaranteed for life... welded armature leads... DIODE motor circuit. Weighs only 27 ounces! Ideal for tool box, kit or pouch. Be sure to send for 4-page folder describing this "palmful of POWER" which will revolutionize 1/4" drilling. Specifications included.

Circle 17 on the Graybar postcard.

**THOR POWER TOOL COMPANY**



## SLASH COSTS 50% WITH DI-EX...

the all new masonry anchor from Diamond

- Engineered for performance
- Designed for cost savings

True One Piece Anchor • Exclusive Threaded Expander Nut—the tighter the pull the greater the expansion • Costs less than other anchors meeting its specifications • Uses Only Standard Drill Sizes • Installs easier • Expanded by either Hammer or Bolt • Plus Holding Power.

Send for free literature containing all details.

Circle 18 on the Graybar postcard.



**DIAMOND EXPANSION BOLT CO., INC.**

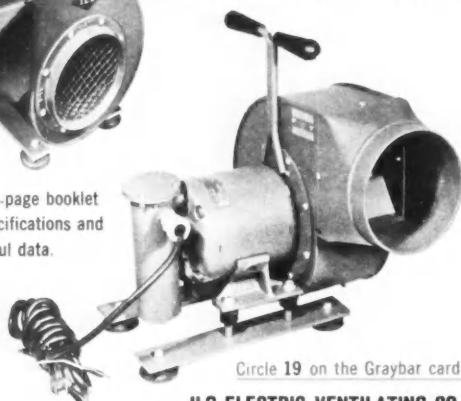
## HANDY PORTABLE VENTILATORS



An ILG portable ventilating set is a handy thing to have around. Speeds up maintenance work in hot spots and confined spaces.

Used with flexible hose to supply fresh air or to exhaust fumes, smoke, hot air. Direct-connected gas engine or electric motor drive. Easily carried by one man.

Send for 8-page booklet giving specifications and other useful data.



Circle 19 on the Graybar card.

**ILG ELECTRIC VENTILATING CO.**



## New Copper-Free Aluminum Eforlets

There's not an ounce of dead weight in the new Efor aluminum conduit bodies. Cast of strong aluminum alloys, they will withstand every use and abuse you can subject them to on the job. Copper-free content assures resistance to corrosion. Furthermore, their diamond-like, mar-proof finish, applied by exclusive electrostatic process—assures additional corrosion resistance: An extra margin of reliability—and at no extra cost! Hubs are clean bushed, covers are supplied with self-retaining screws. Available for conduit and EMT. Send for free sample and Efor catalog.

Circle 20 on the Graybar postcard.



**ELECTRICAL FITTINGS CORP.**

## SOMETHING NEW FROM BERNZ-O-MATIC

### FAMOUS PROPANE TORCH

Here's the tool that has the answer for 101 jobs that need heat. BERNZ-O-MATIC all-purpose torch kit gives you the right flame for doing jobs easier and faster. Complete with pencil flame burner, soldering tip, blow-torch burning head, paint burning attachment and spark lighter—in enameled, steel carrying case.



### TAKE ADVANTAGE OF THIS EXCITING HI-FI LP RECORD OFFER.

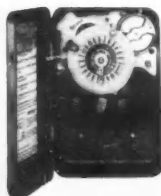
Sizzling COLLECTOR'S ITEM, yours for \$1.00, \$3.98 Value. Record coupon enclosed with each torch kit. Features "Famous Torch Songs of the 20's" custom pressed by Columbia Records. Send for FREE colorful folder which gives full details of this Columbia Record.

Circle 21 on the Graybar postcard.

**OTTO BERNZ CO., INC.**



## INTERMATIC Time Controls for faster installation and greater reliability!



For reliable Time Controls, specify INTERMATIC, the unit that gives you all these time and money-saving features:

- 40-Amp rating—4,375 Watts Tungsten
- Snap-out mechanism for fast, easy mounting
- E-Z See Dial for rapid and accurate settings
- Front-Mounted motor to quickly check operation without removing entire mechanism
- 31 cubic inches wiring space prevents cramped and skinned fingers

There's an Intermatic Time Control for nearly every timing need. Get your free catalog showing models, specifications, etc.

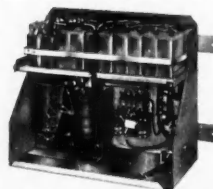
Circle number 22 on the Graybar postcard.

**INTERNATIONAL REGISTER COMPANY**

## operate 3-phase motors from single-phase lines with ADD-A-PHASE

Money-saving 3-phase operation, with no loss of power, is yours with ADD-A-PHASE. Models are available for almost every application—including simultaneous operation of any number of motors, to 80 HP total, with MULTI-MOTOR ADD-A-PHASE. Voltages available: 110/220; 220; 440 input/220 output; 440; 550. Bulletin 400 contains details.

Circle 23 on the Graybar postcard.



**SYSTEM ANALYZER CORPORATION**



On the job technical help, convenient Time Sales and Leasing  
Plans—Expert counter service, speedy handling of will-calls

Outside Salesman

Counter Salesman



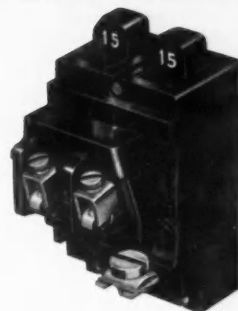
## BULLDOG's Duplex Pushmatic®

The only space-saving breaker with Coil-Magnetic Short Circuit Protection!

A real space saver, with Coil-magnetic short circuit protection . . . it's the only one of its kind. Two circuits in one compact unit, with the famous PUSHMATIC pushbutton convenience. Identical Coil-magnetic short circuit protection for both 15- and 20-amp. circuits . . . and one single, positive, bolted bus connection. Get complete specifications and installation notes in the 80-page PUSHMATIC Load Center Pocket Guide.

Circle number 24 on the Graybar postcard.

I-T-E CIRCUIT BREAKER COMPANY  
BULLDOG ELECTRIC PRODUCTS DIVISION



## BRYANT

### Specification Grade Switches



#### SILENT MERCURY

New Mercury Switches assure absolutely silent operation. Available in white, ivory or brown. Single Pole to 4-Way. 15A-120V AC • 10A-T"-125V • 5A-250V.

#### QUIET AC

A complete line of AC Switches for general application. Single Pole to 4-Way. 15A-120-277V AC. Available in brown and ivory. Lock type feature available in brown.

Send for product bulletin.

Circle 25 on the Graybar postcard.



THE BRYANT ELECTRIC COMPANY



### Series 950 BENJAMIN ELECTRIC EXTENSION CORD REEL

Practically explosion proof—no transfer of current. The revolving arm pays out the cord and replaces it on the pulley.

Accommodates up to 40 ft. of SJO 16/3 cord. Suitable for multiple conductor cord, not over .375" in diameter.

Get more information about the complete line of Benjamin Electric Extension Cord Reels and Grounding Reels.

Circle 27 on the Graybar postcard.

BENJAMIN REEL PRODUCTS, INC.

### SAVE TIME, TAPE AND TEMPER . . . USE SLIPKNOT!

Now . . . Slipknot Plastic Electrical Tape comes packed in the exclusive "Flip-n-Cut" plastic dispenser with new instant cutter . . . on 66', 44' and 30' rolls . . . protects and keeps tape clean . . . cuts without effort . . . saves tape . . . conveniently. It's easier than ever to use. Get the colorful, illustrated brochure on tape types and specifications for all uses.

Circle number 29 on the Graybar postcard.

PLYMOUTH RUBBER CO., INC.



A Small Siren Type A



S2 Siren 2 H.P.



BL Bell 6" or 10"



BR Beacon Ray Light 271

### Sound Thinking Buyers SPECIFY FEDERAL SIGNALS

#### SIRENS • HORNS • BELLS • and WARNING LIGHTS

Send for beautifully illustrated fold-out brochure illustrating a complete industrial signal system. Also contains unique Signal SELECTOR plus standard symbols for electrical and architectural drawings.

Circle 26 on the Graybar postcard.

#### FEDERAL SIGN AND SIGNAL CORPORATION



V 351 Vibratone

#### SYMBOLS



BELL



BUZZER



HORN



SIREN



BATTERY



GROUND

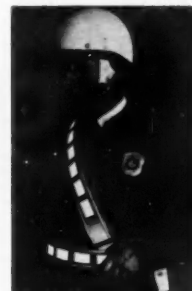
### BAND-O-LITE . . . A MADIGAN SAFETY FIRST!

BAND-O-LITE provides a NEW degree of personal safety and recognition from DUSK-TO-DAWN under the most adverse fog and smoke conditions. Police, State Troopers, emergency repair crews, railroad and airport personnel can now be easily visible when wearing this safety belt. Firemen, overcome by smoke can now be easily located because of the brilliant flashing of the BAND-O-LITE.

Send for NEW detailed information and specification bulletin.

Circle number 28 on the Graybar postcard.

MADIGAN ELECTRONIC CORP.

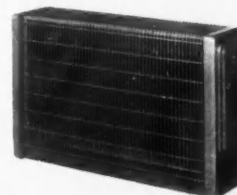


### WESIX EXPLOSION- PROOF HEATER for hazardous locations

Wesix explosion-proof heaters are built to take a beating. Rugged construction plus built-in thermal cutout assure maximum safety for loading docks, hospitals, gas stations and military applications. Class 1, Group C & D shown here.

Send for 8-page catalog containing specifications and installation diagrams, plus illustrations and description of related explosion-proof items.

Circle 30 on Graybar postcard.



LISTED BY UNDERWRITERS' LABORATORIES, INC. • EXTRA HEAVY CONSTRUCTION THROUGHOUT • INTEGRAL 3-HEAT SWITCH AVAILABLE • OUTER SCREEN STANDARD EQUIPMENT • IMMEDIATE AVAILABILITY.

WESIX ELECTRIC HEATER CO.



Power Apparatus



Communication Facilities

**Complete lines include—apparatus for power distribution  
—ventilating, signaling and "intercom" equipment . . .**



## NEW! KLEIN 8-inch High Leverage Plier

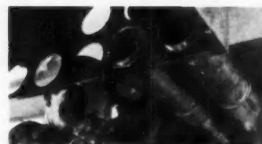
This famous High Leverage Plier developed by Klein is now available in both 8 in. and 9 in. lengths.

Send for more information on Klein products.

Circle 31 on Graybar postcard.

**MATHIAS KLEIN & SONS, INCORPORATED**

## Cut Installation Costs with REYNOLDS ALUMINUM Rigid Conduit!



Reynolds Aluminum Conduit weighs only  $\frac{1}{3}$  as much as steel. It can be handled and installed easily, is easy to cut and thread. Our illustrated brochure shows the complete range of sizes, and offers many hints on using this time-and-money saving conduit. Get your free copy.

Circle number 32 on the Graybar postcard.

**REYNOLDS METALS COMPANY**

## New IDEAL "Yellow 77" Wire Pulling Compound works best where pulling is toughest



- up to 62% greater slip than other compounds
- spreads out on long pulls—won't quit halfway through
- protects insulation against breaks, scrapes and strains
- economical—a little goes a long way
- safe for hands and insulation
- U.L. approved

Send for details.

Circle 33 on the Graybar postcard.

**IDEAL INDUSTRIES, INC.**



Phillips RED HEAD  
self-drilling concrete  
anchors



Phillips JETLOK non-  
drilling concrete  
anchors

NOW  
BOTH

—are available to help you cut electrical construction and maintenance costs.

BOTH

—offer the fastest, easiest, most economical way to anchor conduit, junction boxes, transformers, electric motors and other electric power equipment to concrete surfaces. Red Heads drill their own holes. Jetloks do the job where pre-drilled holes are in order. Both have unequalled holding power.

Send for beautifully illustrated 4-page folder which shows how to take the guesswork out of concrete anchoring.

Circle 34 on the Graybar postcard.

**PHILLIPS DRILL COMPANY**



## NEW! IMPROVED! FLEXITITE PENDENT PUSH-BUTTON STATIONS

All-Neoprene Enclosure • 2-4-6 Button Models

New Neoprene formulation for easier operation at all ambient temperatures.

New legend locations—easier to read, more flexible button operations.

New insulating barriers for safer, more rigid internal construction.

Flexitites feature completely sealed weathertight, corrosion proof enclosures with diaphragmatic push-buttons; safe, maintenance-free operation.

Send for NEW FLEXITITE bulletin covering complete line of push-button stations.

Circle 35 on the Graybar postcard.

**JOY MANUFACTURING COMPANY**

## best step ladder on the market . . . BABCOCK's "Mechanics' Step"!



Electrical contractors demand the superb BABCOCK ladder because . . .

- BABCOCK means quality!
  - Long life means fewer replacements, cheaper in the long run!
  - Moderate price despite high quality!
- There's a right ladder for every job—choose the one you need with help from the BABCOCK Catalog.

Circle 36 on the Graybar postcard.

**W. W. BABCOCK CO., INC.**

## CHECK MARATHON® FOR DRY BATTERIES THAT ARE "PACKED WITH POWER" FOR DEPENDABLE SERVICE

Marathon offers a complete line of quality batteries that are used by industry, municipalities, states, railroads and U. S. Government throughout the country with complete confidence. All Marathon batteries are built to meet the requirements set by the National Bureau of Standards for dry cells.

The outstanding performance of these batteries assures you of trouble-free service when you need it. For a complete listing of all popular long-life batteries send for two-page illustrated bulletin.

Circle 37 on the Graybar postcard.

**MARATHON BATTERY COMPANY**



## Ratchet Type Pipe Threader

### TOLEDO-BEAVER QUALITY TOOLS

offer you a wide selection of pipe and tube working tools and machines. No. 11 & No. 12 Pipe Threaders are the ratchet type for  $\frac{1}{8}$ " thru 2" pipe sizes. Dies are changed instantly for smooth, perfect threads.

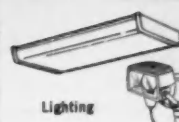
Circle number 38 on Graybar postcard.

**TOLEDO-BEAVER TOOLS, INC.**

**Plus—outside construction tools and equipment  
—indoor and outdoor lighting units and lamps**



Outside Construction Tools



Lighting

**For every weatherproof requirement . . .  
BELL Deluxe Devices, Covers and Boxes!**



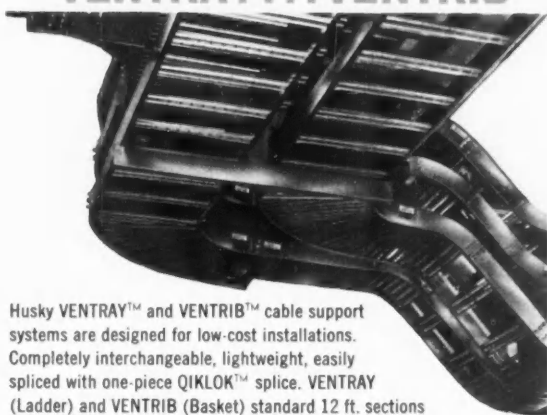
For your weatherproof applications, specify Bell, with the patented Saf-T-Lok cover! Stays in open position when desired; easily snaps shut with slight finger pressure.

Bell switches and solid brass weatherproof covers are available from one to ten gangs in any combination of devices desired. Use with Bell aluminum boxes, one or two gang, 3 to 7 hbs, 1/2" or 3/4" diameter.

Circle number 39 on the Graybar postcard.

**BELL ELECTRIC COMPANY**

**NEW LOW-COST STEEL CABLE CARRIERS  
VENTRAY...VENTRIB**



Husky VENTRAY™ and VENTRIB™ cable support systems are designed for low-cost installations. Completely interchangeable, lightweight, easily spliced with one-piece QIKLOK™ splice. VENTRAY (Ladder) and VENTRIB (Basket) standard 12 ft. sections (6, 12, 18, and 24 inch widths), and complete line of accessories, available on 24 hour notice.

Send for 12-page catalog describing pre-engineered cable tray and basket system.

Circle 41 on the Graybar postcard.

**HUSKY PRODUCTS, INC.  
DIVISION OF BURNDY CORPORATION**

**Reduce labor costs...Speed maintenance and clean-ups with a Pullman Vacmobile**

Vacmobiles pay for themselves many times a year. And there's a model to fit every requirement. Check these features: Save maintenance materials by reducing frequency of waxing floors. • Save on repairing and replacing costly installations by keeping them clean. • Vacuums wet and dry, from ceiling to roof. • Has use in every area of industry, commerce, manufacturing, institutions, farms, laboratories, shops and ships, etc. • Wide variety of specialized cleaning attachments available; germ and dust control hygienic filters, hoses that stretch, even curry comb attachments for animals.

Send for colorful folder describing complete line.

Circle 43 on the Graybar postcard.

**PULLMAN VACUUM CLEANER CORPORATION**

**LIGHT, TOUGH, SELF-SEALING Klean-Kote\*  
ORANGEBURG® FIBRE CONDUIT**

Easy to handle and install. The specified favorite . . . Oranburg Fibre Conduit lays faster at lower cost, longer life and trouble-free handling. Easy on hands and clothing . . . smooth, non-brittle protective coating. Watertight . . . tough self-sealing joints and impermeable walls. Attached couplings, at no extra cost, are flush . . . no staggered joints in trench. Angle couplings, bends, bend sections and other fittings make installation simple and economical.



\*TM U.S. Pat. Applied for

Send for new complete 12-page catalog.

Circle 44 on the Graybar postcard.

**ORANGEBURG MANUFACTURING CO., Div. of The Flintkote Co.**

**ROCKBESTOS FROST GUARD HEATING CABLE KITS**  
For Roof De-icing, Pipe Heating and Soil Heating Applications

Heating cable used around the home, the farm, mobile home parks. Three handy sizes: 60, 40 and 20 ft. kits. These lead sheathed heating cables with flexible non-heating connector permit:

- Repeated "plug-ins" without damage to the cable • Unlimited uses thru weatherproof construction • Better heat conductivity than non-metal sheaths • Easy application to irregular shaped objects
- A COMPLETE UNIT ready to plug into any standard 110-120 volt AC or DC outlet

Rockbestos also manufactures various heating cable constructions for industrial and product uses where a controlled heat source is necessary.

Send for illustrated folder illustrating applications.

Circle 40 on the Graybar postcard.

**ROCKBESTOS WIRE & CABLE CO. Div. of CERRO CORPORATION**



**Diamond Drill Bits save up to 70% on drilling  
reinforced concrete, brick, tile, granite, etc.**



Available in standard sizes 1/4" to 20" O.D. Standard lengths 4 1/2" and 12". Other lengths and O.D.s in Truco Custom Bits. Truco has the most complete line of drilling equipment and accessories to enable you to handle ANY job at much greater profit.

Send for literature describing other TRUCO equipment including a complete line of machines and accessories to assure drilling efficiency in every situation and important savings on every job.

Circle 42 on the Graybar postcard.

**WHEEL TRUEING TOOL CO. • Truco Masonry Drilling Division**

Yours **FREE** Fact-filled bulletins,  
selector guides, samples.

**USE CARDS BELOW!**

**BUSINESS REPLY MAIL**  
POSTAGE WILL BE PAID BY ADDRESSEE

**GraybaR**  
ELECTRIC COMPANY, INC.

420 LEXINGTON AVENUE  
NEW YORK 17, NEW YORK

U.S. Postage  
**PAID**  
First Class  
Permit No. 3333  
New York, N.Y.

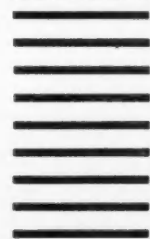


**BUSINESS REPLY MAIL**  
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**GraybaR**  
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420 LEXINGTON AVENUE  
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U.S. Postage  
**PAID**  
First Class  
Permit No. 3333  
New York, N.Y.





Over 130 locations stock more than  
100,000 quality electrical products

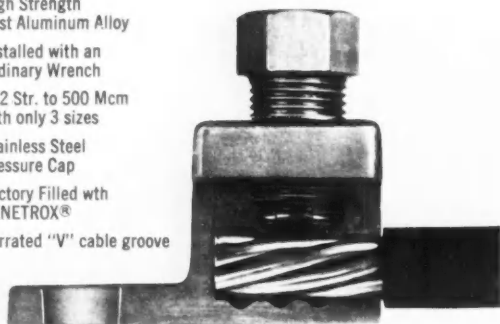
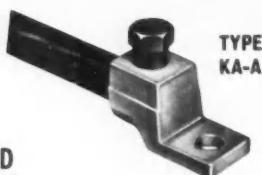
USE  
INQUIRY CARDS  
BELOW!

## NEW UNIVERSAL KA-LUG®

UNDERWRITERS' APPROVED  
FOR ALUMINUM OR COPPER

Check these features:

- High Strength Cast Aluminum Alloy
- Installed with an Ordinary Wrench
- #2 Str. to 500 Mcm with only 3 sizes
- Stainless Steel Pressure Cap
- Factory Filled with PENETROX®
- Serrated "V" cable groove



Send for descriptive bulletin. Circle 45 on the Graybar postcard.

BURNDY CORPORATION

ACT NOW WHILE CARDS ARE HANDY! For your convenience in obtaining important detailed product information right away, just circle appropriate number(s) on card and drop in the mail—it's postpaid.

DETACH AND MAIL CARD TODAY

Gentlemen:

I'm interested in WHAT IT IS, HOW IT WORKS, HOW I CAN USE IT. Please send additional information on items covered by the numbers I've circled below:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49											

MATERIAL AVAILABLE TO READERS IN CONTINENTAL U.S.A. ONLY

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

DETACH AND MAIL CARD TODAY

Gentlemen:

I'm interested in WHAT IT IS, HOW IT WORKS, HOW I CAN USE IT. Please send additional information on items covered by the numbers I've circled below:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49											

MATERIAL AVAILABLE TO READERS IN CONTINENTAL U.S.A. ONLY

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

Get Your Share of the  
Rich Market for  
NUTONE INTERCOM-RADIO!

Tremendous appeal! Home-owners want NuTone Built-in Intercom-Radio for MUSIC throughout the house and in the patio . . . PLUS the convenience of step-saving INTERCOM! Get your FREE Intercom-Radio "PLANNING KIT", colorful catalog, specifications, planning and estimate sheets. Dramatic presentation helps sell profitable installations "on-the-spot"! Circle 46 on the Graybar postcard.

NUTONE, INCORPORATED



SPACE AGE LIGHT ILLUMINATES HOUSE NUMBER . . .  
COSTS LESS THAN 8¢ A YEAR!

NEW ADDRESS-O-LITE provides cool, glare free illumination that makes house numbers visible from sidewalk or street. No bulbs to burn out—uses present doorbell wiring—has built in doorbell push button.

Send for NEW complete information, specifications.

Circle number 47 on the Graybar postcard.

MADIGAN ELECTRONIC CORPORATION

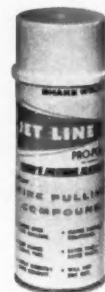


NEW! WIRE PULLING LUBRICANT

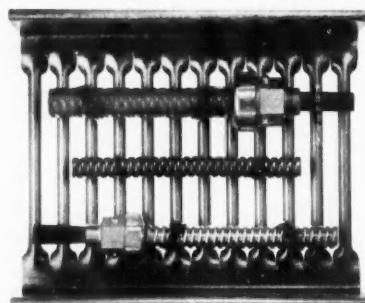
Squirts directly into conduit. FAST—Just a 2 or 3 second shot for most pipes applies sufficient lubricant for easier wire pulling. Convenient to use. Can be kept in tool box. CLEAN—No waste—no mess. Keeps hands free and clean to feed wire into pipe. SAFE—Completely inert, contains no harmful ingredients. For use on rubber, plastic, synthetic, or lead covered wires and cables. WON'T DRY OUT—Retains lubricating qualities. New added feature: when making up long runs with 90° bends, squirt a little lubricant into each bend. ECONOMICAL—16 oz. pressurized can produces 2 gallons. Send for new descriptive sheet covering the complete JET LINE System.

Circle 48 on the Graybar postcard.

JET LINE PRODUCTS, INCORPORATED



It's new and needed—Graybar's got it!



They got together—through Graybar!

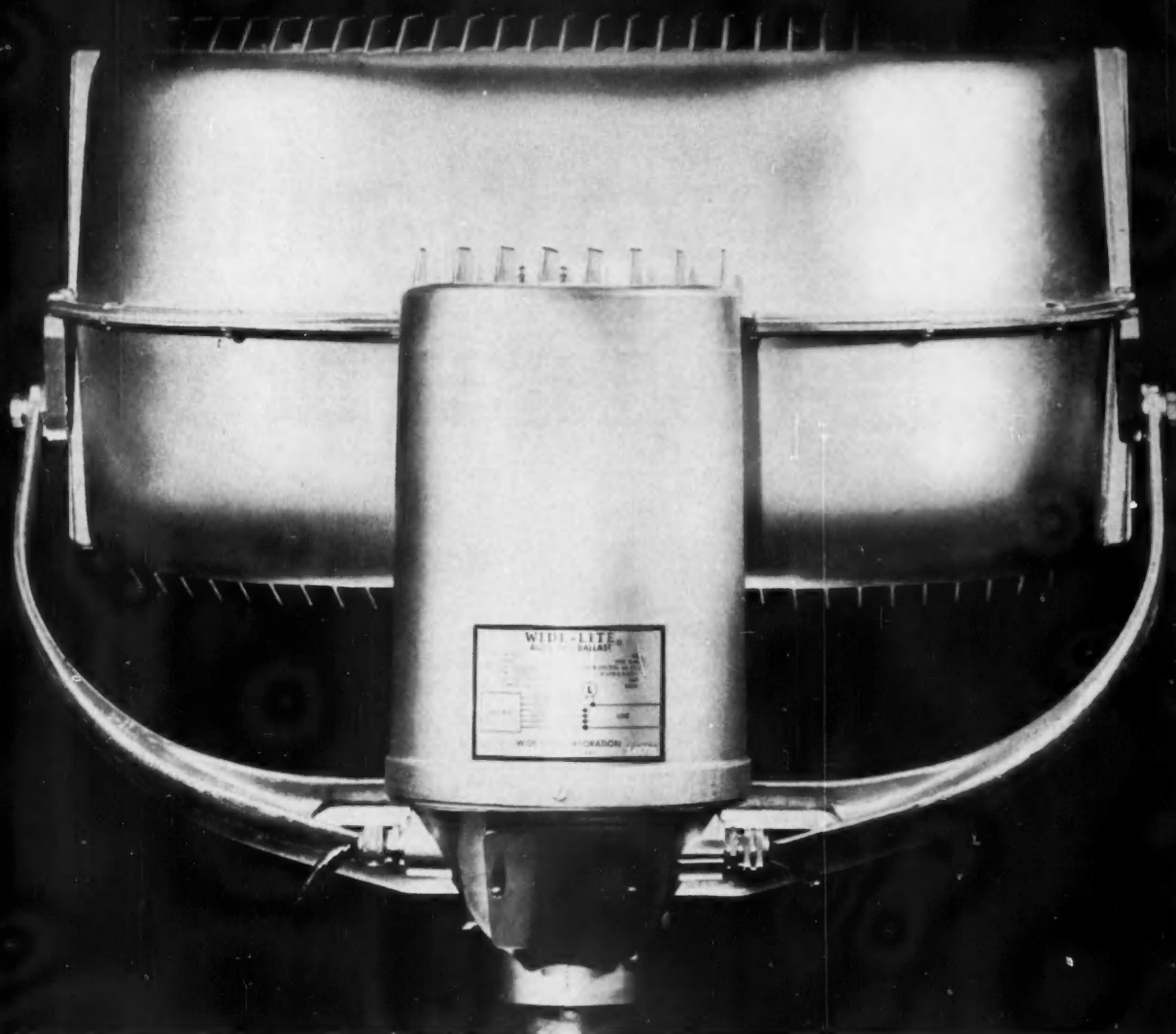
At Graybar, we're electrical specialists. When we see a need, we do something about it. For instance: a unitized cable system, for convenience in design, specification, ordering and installation. We coordinated three of the top names in the business: Simplex for C-L-X cable . . . Globe for Cable-Strut Trays . . . Thomas & Betts for connectors. Result—an engineered package for power distribution systems. Let us tell you more about this packaged cable system . . . or any of the up-to-the-minute developments in the electrical field. Call Graybar—for everything electrical. Circle 49 on the Graybar postcard.

**Graybar**  
ELECTRIC COMPANY, INC.

See the Yellow Pages  
for the Graybar location  
nearest you.







## This is a photo of longer lamp life!

### Why?

Because it shows the exclusive features built into every Wide-Lite floodlight to assure proper cooling. And mercury vapor lamps last longer when cooled properly!

Notice the deep, die-cast fins in the top and bottom of the fixture. How many other 1000-watt floodlights have the 1,872 square inches of heat-dissipating surface the Wide-Lite unit has? You guessed it. None.

Notice, too, the ballast location. It's connected to the fixture for easy one-unit mounting. But it is a *separate* component so that ballast heat cannot combine with lamp heat to compound the problem. And it has 348 square inches of heat-dissipating surface all its own.

Besides making lamps last longer,

these exclusive heat control features give Wide-Lite floodlight owners another big advantage: proper color-correction. Because if a color-corrected mercury vapor lamp runs too hot, it loses its ability to "correct" the color of the light it projects, and you get the eerie coloring effect of clear mercury vapor lamps.

Next time you see a big Wide-Lite floodlight on the job, take a look at the 2,220 square inches of cooling area built into the fixture and ballast. That's 2,220 reasons why the Wide-Lite is so provably better.

Why not write for all the *other* reasons?

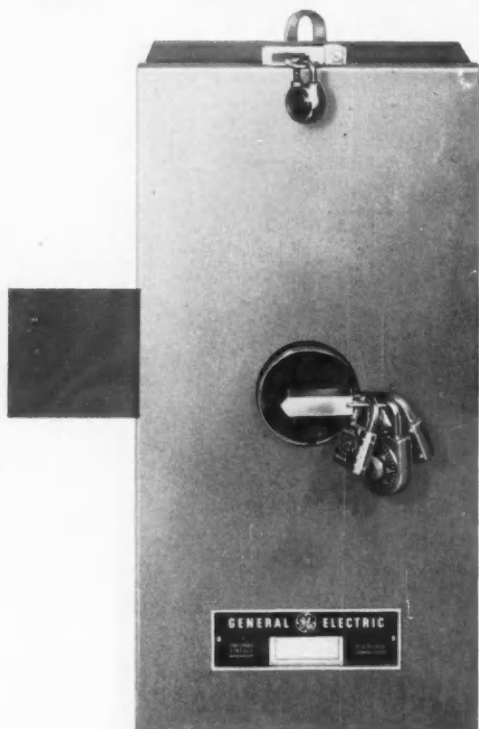
WIDE-LITE CORPORATION, a Division of Esquire, Inc., Dept. YB 1, 4114 Gulf Freeway, Houston 1, Texas.



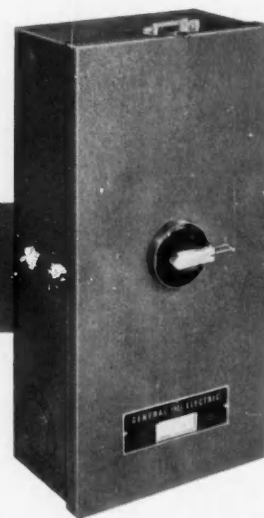
**FLOODLIGHTS  
BALLASTS  
INDOOR LUMINAIRES**

**NOW AVAILABLE**

# A NEW complete for all General Electric



**FEATURING: NEW NEMA 12 . . . without knockouts** — Fully conforms to all NEMA 12 and Joint Industry Conference standards. External mounting feet. Oil-tight and dust-tight. Removable hinged covers for easy wiring. Hinged rotary-operating mechanism. Handle interlocks with cover. Door cannot be opened with breaker ON. Provisions for multiple padlocking. The K 1000 Line, NEMA 12 can be wired with incoming lines at Top or Bottom, can save you up to \$100 on cable cost alone.

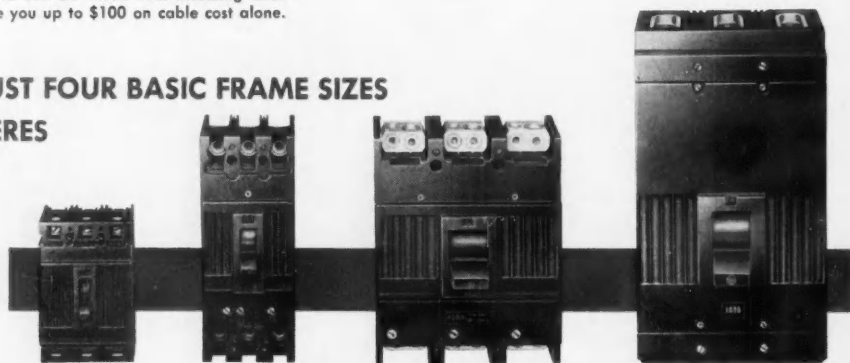


**NEW NEMA 1, 1A (E 100, F 225, J 400)** — Plenty of knockouts. Convenient key hole mounting. External rotary-operating handle mechanism. Provision for up to three padlocks for extra safety. Handle interlocks with cover. Easy wiring with removable cover and handle. Trip indicating. Oil and dust resistant.

## SIMPLE TO SELECT . . . JUST FOUR BASIC FRAME SIZES FROM 15 TO 1000 AMPERES

and all available in conventional, Hi-Break\*, Vu-Break\*, Magnetic only and non-automatic models.

(\*Trade Mark of General Electric Company. Illustrations are not to scale)



**E 100** — 15 to 100 amperes; 240, 480 volts

**F 225** — 70 to 225 amperes; 240, 480, 600 volts

**J 400** — 125 to 400 amperes; 240, 480, 600 volts

**K 1000** — 125 to 1000 amperes; 240, 480, 600 volts

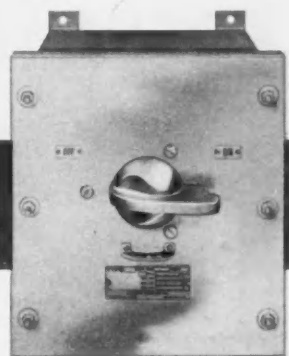
# line of enclosures circuit breakers



**NEMA 1 . . . handle-thru-cover** — Cover cut-out gives direct access to breaker handle, trip indication. When tripped, handle moves to mid-position between ON and OFF. Plenty of knockouts for easy wiring. Locking shelf on front for personnel safety. Available for flush or surface installation.



**NEMA 3R . . . raintight** — Available with provisions for inter-changeable raintight hubs, from 1 to 2½" diameter (E 100, F 225). Also available with blank end walls for use with Myers-type hubs from 2½ to 4" diameter. Drip-tight, moisture resistant. Top-hinged cover removed easily.



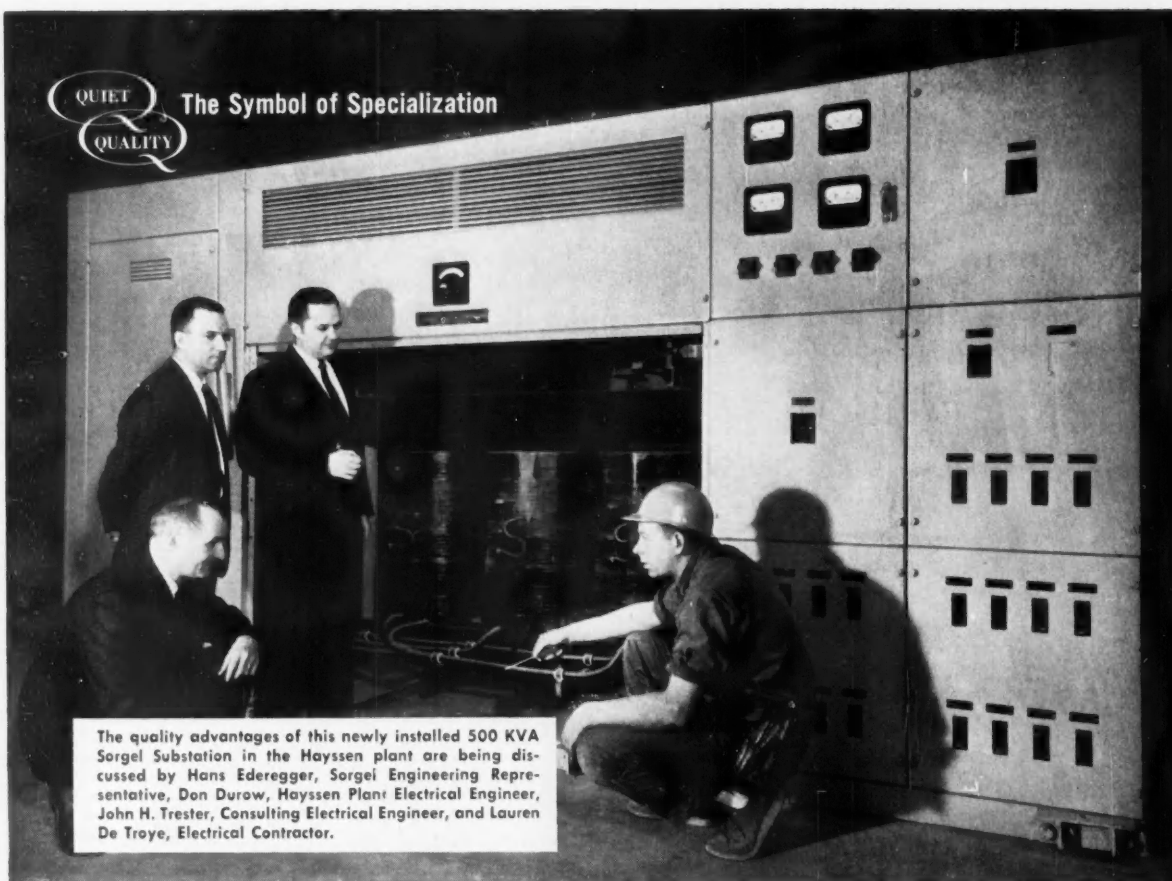
**NEMA 4, 5 . . . Water and dust-tight.** Available in either stainless steel or cast iron. High-nickel stainless steel used throughout — even for mounting brackets. Cast iron enclosure offers wing nuts to facilitate clamping cover tightly against neoprene rubber gasket and enclosure.

Designed for use with the new G-E line of molded case circuit breakers with space savings up to 70%. Only four basic frame sizes cover every need from 15 to 1000 amperes. Simple to select. Simple to apply. Versatile. Compact. Specify General Electric circuit breakers and enclosures for your next installation. Now in stock at your nearest General Electric Distributor or write Circuit Protective Devices Department, Plainville, Connecticut.

**GENERAL**  **ELECTRIC**



The Symbol of Specialization



The quality advantages of this newly installed 500 KVA Sorgel Substation in the Hayssen plant are being discussed by Hans Ederegger, Sorgel Engineering Representative, Don Durow, Hayssen Plant Electrical Engineer, John H. Trester, Consulting Electrical Engineer, and Lauren De Troye, Electrical Contractor.

## ANOTHER EXPERIENCED ELECTRICAL TEAM SPECIFIES AND BUYS SORGEL

In Hayssen Manufacturing Company's new, modern Sheboygan, Wis., plant, the electrical distribution system is of prime importance. In planning, the *plant engineer* insisted on quality dry-type transformers at the heart of the electrical distribution system, as he wanted the utmost in dependability to assure a continuous power supply for all production machinery, lighting, and electrically operated tools. The *consulting engineer* wanted a distribution system that would assure continuity of operation and maximum efficiency at all load conditions. The *electrical contractor* was interested in the kind of economy provided

through equipment that was easy to install and guaranteed to perform as rated. After careful comparisons, this team specified Sorgel above all others.

These quality-conscious men liked Sorgel's guaranteed performance data policy and national reputation for designing and providing the finest substations and dry-type transformers. The results are exactly the type of dependable, highly efficient electrical distribution system Hayssen (one of the world's leading manufacturers of intricate automatic packaging machinery) insisted on.

**WRITE FOR LATEST SORGEL LITERATURE TODAY.**



**SORGEL**  
SOUND-RATED DRY-TYPE  
TRANSFORMERS

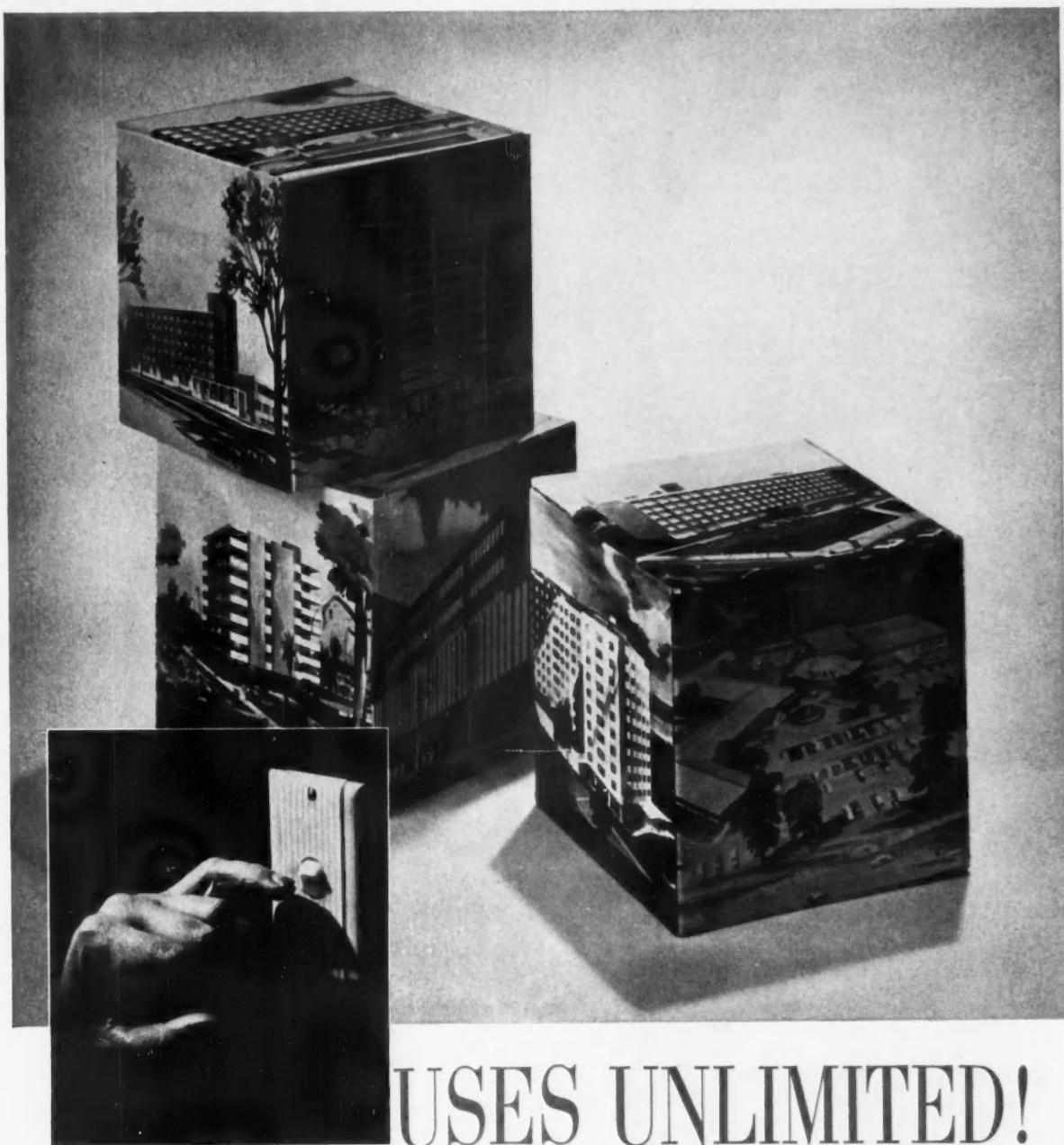
Complete Line for Every Purpose up to 10,000 Kva, up to 15,000 Volts,  
Including Special Transformers and Saturable Reactors

**SORGEL ELECTRIC COMPANY**

836 West National Ave., Milwaukee 4, Wisconsin

Sales engineers in principal cities. Consult the classified section of your telephone directory or communicate with our factory.





**USES UNLIMITED!**

**ONLY ROCKER-GLO WITH SO MANY  
STYLES OFFERS THE UNUSUAL TOUCH  
FOR EVERY KIND OF BUILDING**

Write Dept. ECM-1062

**PASS & SEYMOUR INC.**  
SYRACUSE 9, N. Y.

BOSTON

CHICAGO

LOS ANGELES

SAN FRANCISCO





## ALL AMPROBES READ...

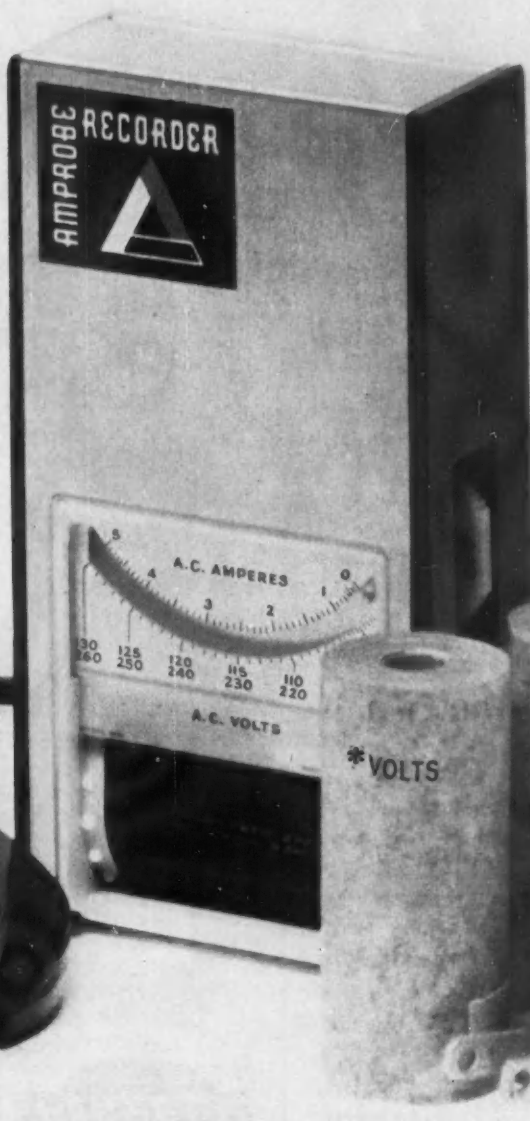


Here are two new Amprobe instruments. The one on the left is our latest model snap-around volt-ammeter. As with all Amprobes in the complete line, this versatile new RS-1000 fills a specific need—that of measuring higher loads. It tests for voltage (3 ranges: 0-150/300/600 v AC), current—without interrupting service—(5 ranges: 0-15/40/100/300/

1000 amps AC) and resistance (1 range: 25 ohms midscale) for only \$69.50†.

■ But sometimes troubles occur when you can't be there to take readings. And that's when only Amprobe's new miniature Dual Recorder will help. Night or day, it stays on the job when you can't—writing an accurate, permanent record of fluctuations in volts or amps on ink-

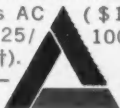
less, pressure-sensitive paper charts that load easier than film into a camera. To switch from volts to amps, just change the chart. Without the chart in place you have a rugged, direct-reading volt-ammeter—it's actually four instruments in one! ■ The new Dual Recorder is available in two versions. Both are supplied complete with charts, probes



**THIS ONE WRITES TWO\***

and leather carrying case. Each has two expanded-scale voltmeter ranges (95-130 and 190-260 v AC), while current ranges differ: Model AVA1: 0-10/50/250/500 amps AC (\$134.85 †); AVA2: 0.5/25/100/250 amps AC (\$129.85 †).

Amprobe Recorders are



**AMPROBE INSTRUMENT CORPORATION**  
630 MERRICK ROAD, LYNBROOK, NEW YORK  
IN CANADA: ATLAS RADIO CORP., 50 WINGOLD AVE., TORONTO

also available for individually recording amps, volts, temperature or any other electrically transduceable variable. Prices start at \$69.50 †. For complete details see your distributor or write today. †All prices slightly higher outside U. S.

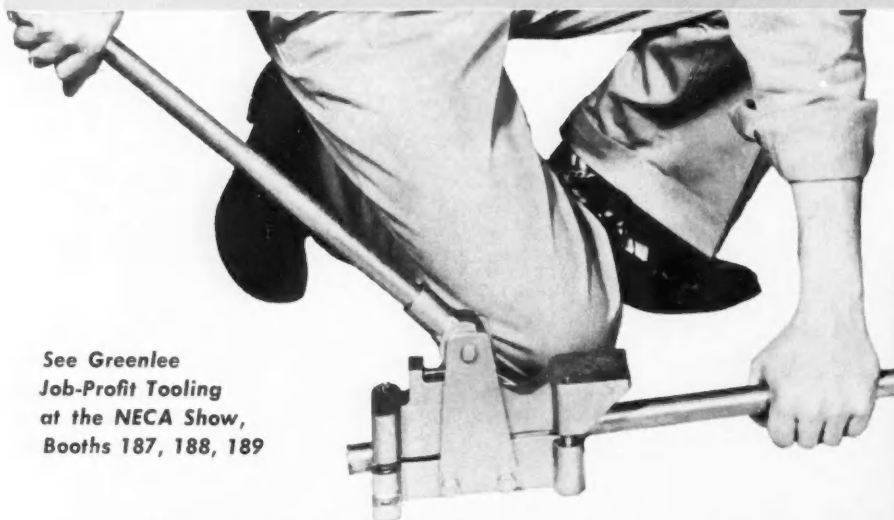
**WIN A FREE RECORDER!** Amprobe is giving away a new Dual Recorder in every trading area in the U.S. between now and December, 1962. To be eligible, just ask your distributor for an entry card, fill it out and mail it to us. Nothing to buy! A new drawing every month! Ask for demonstration today!

# Now...there's a "LITTLE KICKER" for 3/4" E.M.T.

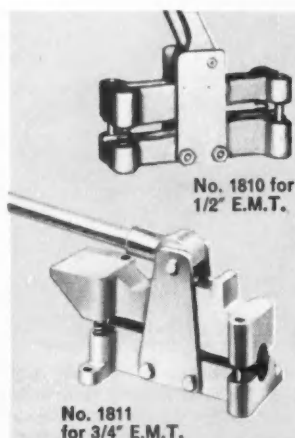
... and it has all the advantages that made the Greenlee 1/2" "LITTLE KICKER" an immediate favorite with so many electricians and contractors:

- **FAST**—bends perfect offsets in just 2 seconds.
- **ECONOMICAL**—eliminates the need for costly offset connectors.
- **EASY**—just press down on the handle.
- **ACCURATE**—every bend is identical... no time lost refitting or cutting and trying.

See your Greenlee Distributor for a demonstration today!



See Greenlee  
Job-Profit Tooling  
at the NECA Show,  
Booths 187, 188, 189



Now you can eliminate the need for costly offset connectors wherever 1/4" or 1/2" E.M.T. is used in exposed installations. The new Greenlee "Little Kickers" save you up to 12c in material per connection... and cut hours off every job.

Both "Little Kickers" are in stock at leading electrical and industrial supply houses.

Order NOW.

ANOTHER NEW ADDITION TO THE GREENLEE LINE  
OF JOB-PROFIT TOOLING

GREENLEE TOOL CO., 2018 Columbia Ave., Rockford, Illinois





GENERAL ELECTRIC SILICONE

RUBBER INSULATION

Big in advantages



Small on installed cost

Most engineers know that silicone rubber makes a superior insulation for cable. The chart below demonstrates it. But do you know that the price of silicone rubber insulation is surprisingly low when the total installed cost of the job is figured?

That's because G-E silicone rubber insulated cable gives you twice the current capacity, twice the overload protection of ordinary cable. In old installations, silicone rubber cable can be used in existing conduits without excessive reconstruction. On new installations you are buying the extra capacity and overload protection needed in the years ahead. Usually takes much less work to install it, too.

Typical Properties of Cable Insulations	Silicone Rubber	SBR Rubber	Butyl Rubber	Oil-Base Rubber	Polyvinyl Chloride	Polyethylene	Polytetrafluoroethylene
Maximum Temperature Rating	250°C	75°C	90°C	75°C	105°C	75°C	250°C
Insulation Resistance (Megohm Constant)	30,000	2,000	30,000	21,000	2,000	50,000	50,000
Power Factor, %	0.1	4.5	3.0	5.0	5-8	0.05	0.03
Tensile Strength, psi	1,200	800	800	1,200	1,500	1,500	2,000
Elongation, %	500	350	400	300	200	400	150
Heat Aging @ 200°C	Excellent	Poor	Poor	Poor	Poor	Melts	Excellent
Low Temperature Characteristics @ -55°C	Very Flexible	Brittle	Flexible	Brittle	Brittle	Stiff	Stiff
Corona Resistance	Excellent	Poor	Fair	Good	Good	Fair	Poor
Radiation Resistance Ergs/gram	10 <sup>10</sup>	10 <sup>10</sup>	10 <sup>9</sup>	10 <sup>10</sup>	10 <sup>10</sup>	10 <sup>10</sup>	10 <sup>7</sup>
Flammability	Burns to non-conducting ash*	Burns	Burns	Burns	Self-Extinguishing	Burns	Self-Extinguishing

\* Self-extinguishing silicone rubber compounds also available.

Get the full story on the economic and insulation advantages of General Electric silicone rubber. Write Section DD1071, Silicone Products Dept., General Electric Company, Waterford, New York.

**GENERAL**  **ELECTRIC**

# Stab-lok® magic main profit maker



The new Stab-lok main breaker is available in 100- and 125-amp, as well as 150- and 200-amp ratings.

**makes it possible  
for \$75.08 to buy  
everything you need for any  
150-and 200-amp load  
center or main breaker panel job!**

Four items to stock—not 10, not 12—with at least twice the turnover rate, at a fraction of the cost... that's the big story in Stab-lok's new main breaker system!

Need a 150-amp, 30-circuit load center? Use the Stab-lok 120-30. Need a 150-amp, 30-circuit main breaker panel? Insert the exclusive Stab-lok bolt-on main breaker and use the 120-30 again! And the com-

pleted device occupies much less space and is many pounds lighter than old style main breaker panels.

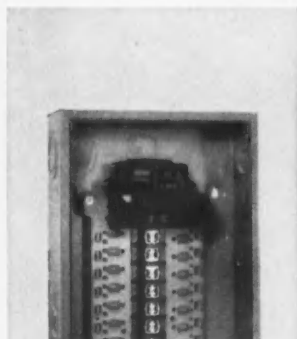
With only 4 items to stock, you'll have what you need when you need it. There's less money invested, less shelf space required, less record-keeping, no confusion...no aggravating labor losses because the wrong items are delivered to the job!

This important new Stab-lok development, like every

## here's how it works:



1. Remove main lugs from standard Stab-lok load center. Slide main breaker over studs.



2. Tighten stud nuts. Breaker is now firmly bolted in place (and you haven't lost any branch breaker capacity!)



3. Remove knockout in trim to accommodate main breaker handle. That's all there is to it!

## here's how little it costs:

1 Stab-lok 120-30 (150-amp, 30-circuit) load center, comes with surface/flush trim in the same box!	\$14.93
1 Stab-lok 124-40 (200-amp, 40-circuit) load center, comes with surface/flush trim in the same box!	19.15
1 Stab-lok 2B-150 (150-amp) main breaker	20.50
1 Stab-lok 2B-200 (200-amp) main breaker	20.50
4 Items	Contractor's Cost: \$75.08

Compared to Manufacturer A's 10 items for \$137.08, Manufacturer B's 12 items for \$155.68 and Manufacturer C's 10 items for \$157.95. A complete inventory and cost analysis will be sent to you upon request.

Stab-lok development over the past 12 years, has been achieved without obsoleting a single existing stock item in the Stab-lok catalog! We've planned it that way, in line with our famous "Progress Without Obsolescence" policy, to protect every Stab-lok user. No wonder Stab-lok is known as the industry's only completely engineered system.

Your FPE man will be calling on you soon. He'll show

you how the new Stab-lok main breaker system means much more profit for you!

FEDERAL PACIFIC ELECTRIC CO., 50 PARIS ST., NEWARK N. J.

**FPE** **FEDERAL  
PACIFIC**  
growth through creative energy

NEW F40  
GENERAL ELECTRIC

F40/54  
GENERAL ELECTRIC

POWER GROOVE  
GENERAL ELECTRIC

F-40

F-40/54

POWER GROOVE\*

This is the  
only lamp value  
General Electric  
doesn't brag about

**BUT IT SHOWS YOUR CUSTOMERS  
GET EXTRA LIGHT FOR A DOLLAR.**

Almost every General Electric fluorescent lamp gives your customers a lot of extra value they can't get from other lamps. Why almost? Because we won't claim extra value unless the difference is really significant.

Like the New G-E F40. Here is extra value we can claim because this lamp gives your customers a basically higher standard of light output than any other forty-watt

lamp—at not one penny extra cost.

Or the General Electric Power Groove Lamp. It is the most powerful fluorescent your customers can buy—a powerful claim for an unusually powerful lamp that lets you reduce fixtures in new installations, put a lot more light economically on an area indoors or outside.

Or the Slimline, most popular eight-foot fluorescent, or the High Output—both these lamps were increased in light output rating and life during the past year. Or



Accent  
on  
**VALUE**

SLIMLINE  
GENERAL ELECTRIC

HIGH OUTPUT  
GENERAL ELECTRIC

ALL-WEATHER  
GENERAL ELECTRIC

**SLIMLINE**

**HIGH OUTPUT**

**ALL-WEATHER\***

the All-Weather, the only fluorescent that maintains its full undiminished light output in zero temperatures.

However, there is one instance where General Electric has not substantially increased light output. For this lamp, the F40/54, General Electric makes only the claim to give at least as much light and as much life as any other lamp. For older (Pre-1954), pre-heat systems using standard 40-watt fluorescents, your customers may want it. But the only way to get the most light (which is what most people prefer) in any standard 40-watt system is to

use the New General Electric F40.

And to get complete facts on real extra values, for fluorescents as well as other lamps, see your Large Lamp Representative or write General Electric, Large Lamp Department C-257, Nela Park, Cleveland 12, Ohio.

\* Registered trademark of General Electric Co.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

# Murray introduces the New Look

*...in its Trade-Mark and in its Load Centers*



There's a snappy new look to Murray's trade-mark that is symbolic of a major breakthrough in style...in quality...and in service.

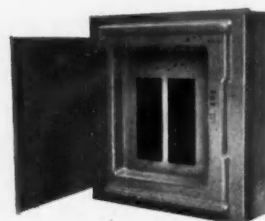
New designs and new manufacturing techniques bring you top value in electrical distribution equipment, plus speeded-up deliveries to get them to you when you need them.

First of Murray's products to get the "new look" is our line of MP Load Centers. No need to hide this stylish load center in an out-of-the-way location. You'll be proud to install it in a convenient spot in full view of your customer. Its simple, modern lines

blend with any background.

Besides modern, attractive styling, Murray Load Centers offer you distinct design features that mean easy installation and long, trouble-free service life. What's more, you can equip them with our MP Guaranteed for Life, fully magnetic Circuit Breakers, the only Guaranteed for Life breaker available today!

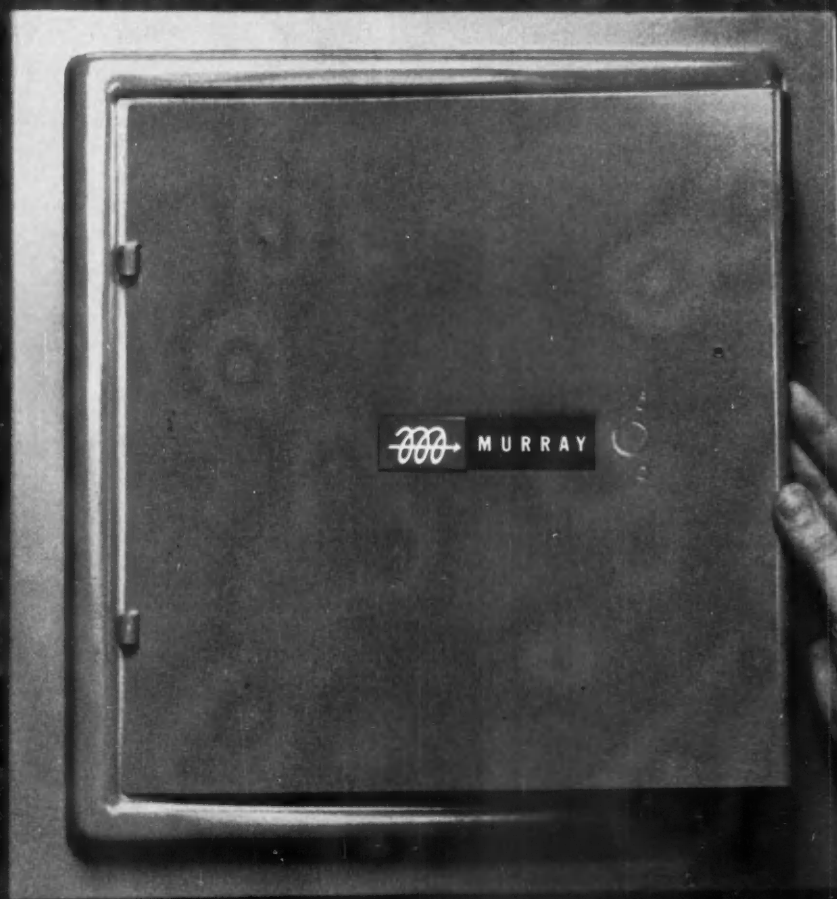
Find out how you can put Murray's "New Look in Load Centers" to work for increased sales and higher profits. See your Murray distributor, or write to Murray Manufacturing Corporation, 1250 Atlantic Ave., Brooklyn 16, N. Y.



Easy-opening door has unbreakable snap-lock. No obtrusive handles.



Equipped with the Only Guaranteed for Life Fully Magnetic Circuit Breaker.





BEFORE YOU INSTALL ANOTHER MOTOR STARTER,  
MEASURE ITS TOTAL VALUE

## Fast, easy installation is essential, but what other factors should determine your choice?

**Q**uick installation? It's money in your pocket! Easy maintenance? Dependable operation? Nobody specifies a starter that doesn't deliver these important customer benefits. And, these qualities have always been built into all Cutler-Hammer motor starters.

But, we've long been aware that other considerations are equally important to our customers. Hundreds of contractors have told us they often choose Cutler-Hammer starters because of certain *non-product* factors which, combined with top quality and performance, give total value every time:

**"OFF-THE-SHELF" AVAILABILITY.** Over 91% of your standard starter needs are available from local stocks. Even very special requirements can often be handled overnight. With Cutler-Hammer, complete starters or replacement parts are a phone call away . . . from the balanced stocks of more than 600 Distributors backed by 66 district offices and 17 regional warehouses.

**COMPLETE SERVICE.** Both your Distributor and your Cutler-Hammer man treat your application problems as their own. Together they are equipped to handle your special requirements—and emergencies—in just a matter of hours.

**FULL PRODUCT LINE.** Cutler-Hammer offers you a complete line of ten NEMA sizes . . . 00 through 8. The entire starter line is designed to rugged industrial standards . . . is proven in hosts of applications . . . and exceeds NEMA requirements in every respect.

So, next time you're contemplating a motor starter, don't stop short with an evaluation of product factors only. Also measure the non-product values you get with Cutler-Hammer's immediate availability, complete service, and a full product line. For complete details, send for bulletin LO-70-U241. And for Cutler-Hammer's *total-value* story, call your local Cutler-Hammer Distributor today!

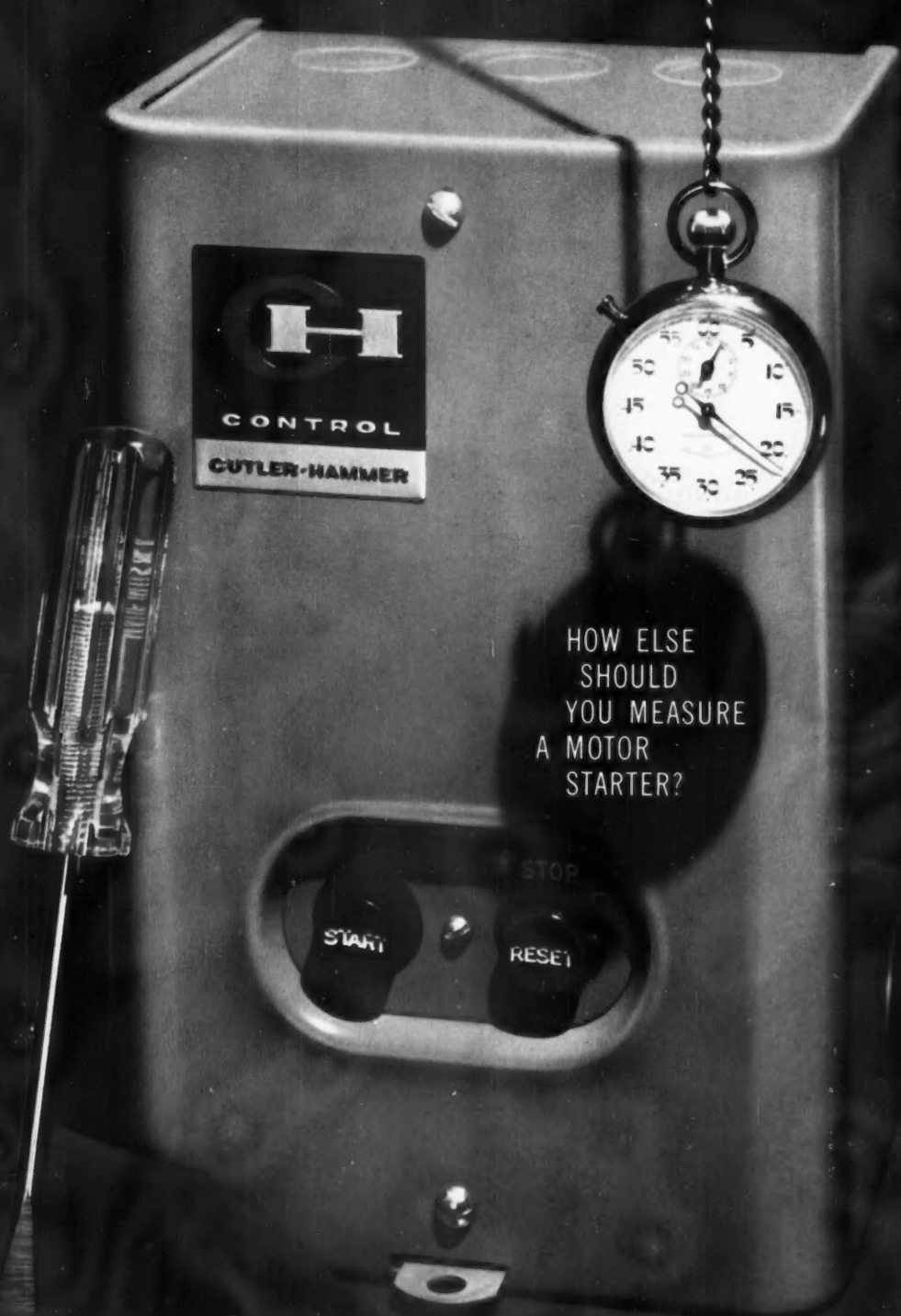
WHAT'S NEW? ASK...

# CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus, Inc., Cutler-Hammer International, C.A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S.A.







HOW ELSE  
SHOULD  
YOU MEASURE  
A MOTOR  
STARTER?

an  
editorial  
by  
Chromalox

# here's how electrical contractors can get more comfort heating jobs

Many electrical contractors tell us "Sure, we know about the potential in electric comfort heating. But what can we do to get profitable jobs?"

The answer is basically simple. Do three things:

1. Work with the sales departments of the power suppliers in your area. They sell electricity. And comfort heating is a wide-open source for added use of electricity. Too, they know about the buildings being planned and erected and are in contact with architects, consulting engineers and owners as their plans develop. You can work with them to influence the use of electric comfort heating in new buildings.
2. Work with the electric comfort heating manufacturers and their field men. Chromalox, for instance, with over 250 trained field personnel and over 1000 authorized Chromalox distributors, will provide the help you need. Our headquarters will supply you with basic know-how, equipment data, job planning methods, etc. Our field men and distributors will help insure prompt delivery and provide in-

stallation assistance, give you all the necessary aids needed to sell and service your local markets.

3. Develop comfort heating prospects through your own initiative. Practically every new store, building, apartment—and many older ones—are prospects for the service and equipment you normally sell, and for *electric comfort heating*. A presentation of the dollars and cents facts, the comfort advantages and the operating economies may well get you the electric heating job, too. Chromalox will be glad to help you get these facts.

In other words, to develop profitable electric comfort heating jobs, *you*, the electrical contractor, must *want this business* and be willing to *work for it!* And remember—your trade publications, associations and leading manufacturers in the electric comfort heating field are ready, even anxious, to help you . . . help yourself . . . to added profits.

## The time is **NOW!**

Write Chromalox today. Ask for bulletin G-00500. It details the facts, opportunities and profit potentials in the booming electric comfort heating market.

WC-17

**CHROMALOX®**  
**ELECTRIC**  
**HEAT**



EDWIN L. WIEGAND COMPANY  
7790 Thomas Blvd. Pittsburgh 8, Pa.



# NEW CONCEPT IN STYLED OUTDOOR LIGHTING

## **"BETTER LOOKING— BETTER LIGHTING"**

Line Material, a leader for many years in outdoor lighting, is also a leader in the styling of outdoor lighting fixtures. To meet the need for equipment that not only performs efficiently but presents a pleasing daytime appearance, modern styling has been combined with efficiency.


L-M's outdoor area lighting equipment, has been styled by Jean Reinecke, noted industrial designer. Whether your requirements are for high intensity, or soft, low level illumination, L-M has a styled luminaire for practically any outdoor area lighting application.

L-M lighting units are all designed and engineered for ease of installation and maintenance; good light control to eliminate glare; and sturdy, weatherproof construction for long life.

Ask the L-M Field Engineer, call any L-M office for the name of your Authorized L-M Distributor, or write to Line Material Industries, Milwaukee 1, Wisconsin.

### **LINE MATERIAL® Industries**

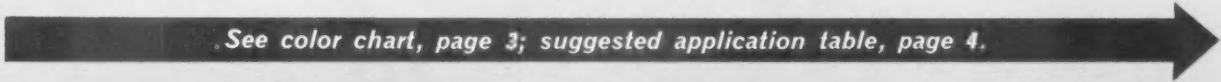
McGRAW-EDISON COMPANY

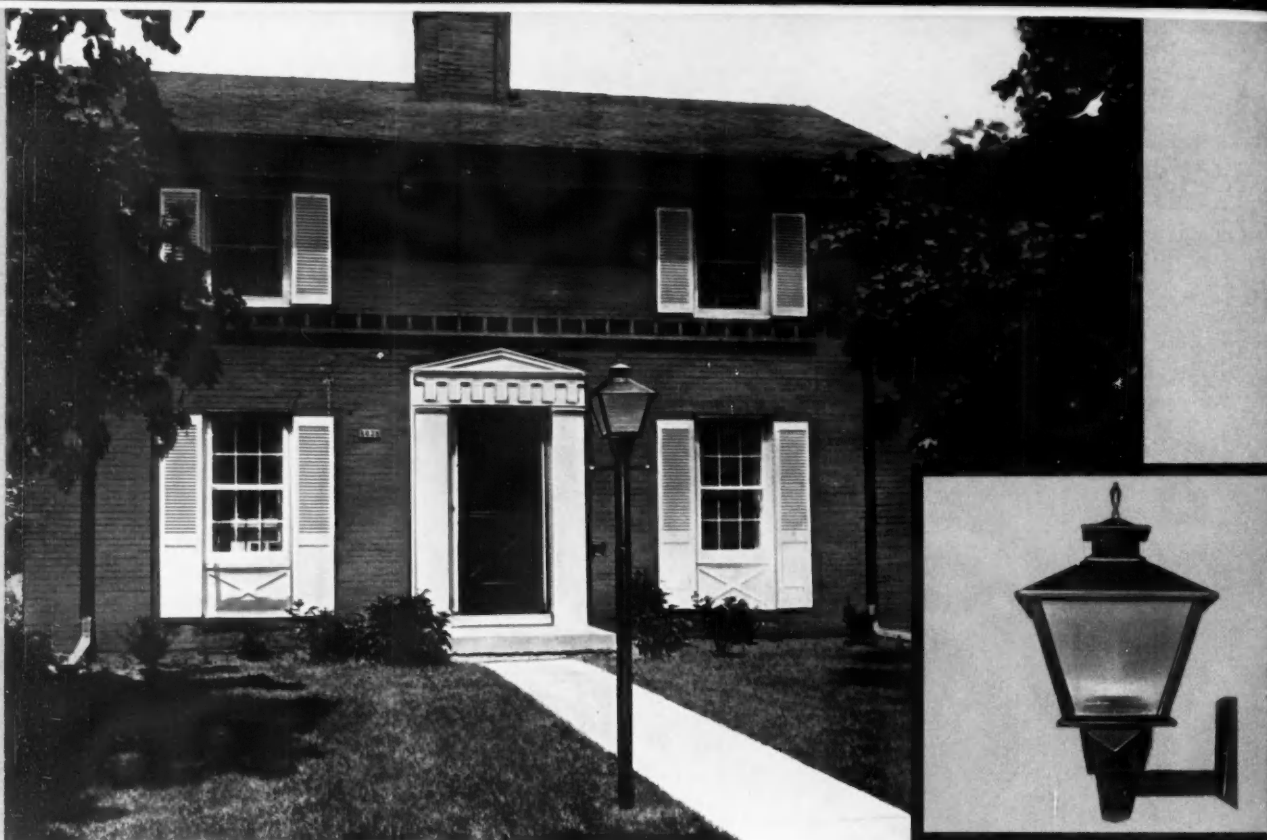


**StyleKing™ PTL's** handsomely styled luminaire for up to 620 watts incandescent or 250 watt mercury with built-in ballast. Photocontrol accommodation if desired. Choice of 3" or 7" mounting collar. Choice of eight colors; seven light patterns with glass refractor, two with plastic refractor. Excellent light control prevents glare.

**Stylette™ PTL's** smaller model with the same beautiful daytime appearance and nighttime efficiency. Easily installed, easy to maintain. Provides excellent, glare-free lighting. To 405 watt incandescent with glass refractor, 200 watts with plastic refractor. Same light patterns as the StyleKing; 3" mounting collar; choice of eight colors.

See color chart, page 3; suggested application table, page 4.





## LAWN-GLO™ TRADITIONAL DESIGNS

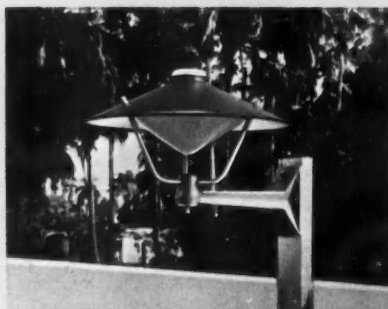
Authentic reproduction of an early American carriage lantern. Prismatic shatterproof panels provide scientific light control, direct light downward, prevent glare. Available for either post or wall mounting. Interior is easily

accessible to make maintenance easy. For 150 watt or smaller standard base lamps. Luminaires are all-aluminum construction and completely weatherproof, in a choice of black and gold, or white and gold.

## LAWN-GLO™ CONTEMPORARY DESIGNS



Weatherproof, all-aluminum long-life construction, and easy maintenance are features of this highly efficient modern Style A Lawn-Glo unit. Choice of eight colors. Available with or without photocontrol.



Style B Lawn-Glo unit provides a sturdy bracket for wall-mounting. Smart modern design. Like all Lawn-Glo units, this one provides soft, low-level lighting. All Lawn-Glo's accommodate 150 watt or smaller lamps.



Style C Lawn-Glo similar to the Style B but designed for post-top mounting. All contemporary Lawn-Glo's available in choice of decorator colors. All Lawn-Glo units are easily accessible for cleaning or relamping.



**LINE MATERIAL® Industries**



**"BETTER LOOKING—BETTER LIGHTING"**

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUPS AND FUSE LINKS • LIGHTNING ARRESTERS  
CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT





## ANOTHER NEW CONCEPT IN STYLED OUTDOOR LIGHTING

**STYLED MERCURY** Here is high intensity illumination at its best. The Styled Mercury line provides extremely high efficiency, for mercury lamps of 400, 700, and 1000 watts at 30-foot mounting height. The unit lights up to 11,000 square feet to an intensity of 6 footcandles. The high intensity of these units aids efficiency in highway and parking lot lighting. Fewer units are needed, with fewer poles, less wiring, less ground space. Efficient optical system with glass refractor to control the light and eliminate glare. Particularly desirable at airports because of the absence of upward glare. Available in the four styles and eight colors as shown.

### CHOICE OF EIGHT COLORS

StyleKing, Stylette, the Styled Mercury line and the contemporary Lawn-Glo line are available in these color choices:



Carnation Pink



Niagara Grey



Kentucky Green



Walnut Brown



Electra Blue



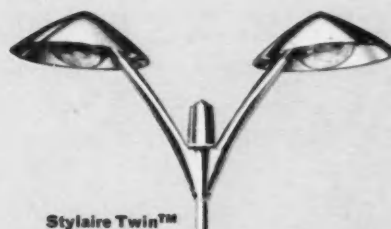
Black



Brushed Aluminum



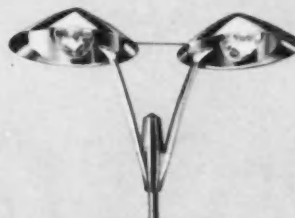
White



Styleaire Twin™



Styleaire™



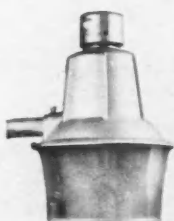
Styleaire Dyad™



Stylevue™

# Unistyle™

New Unitstyle luminaire, latest development in high intensity horizontal-burning mercury units—also styled by the leading designer, Jean Reinecke. Built-in ballast, for mercury lamps through 400 watts. Excellent light control with specially designed reflector-refractor optical system. Photocontrol available if desired.



## L-M Styled Suburbanaire™

an open-type styled unit for efficient lighting in neighborhoods, commercial locations, marinas, farms for Dusk-to-Dawn lighting. Mercury or incandescent. Glass or plastic refractor.

## LINE MATERIAL®



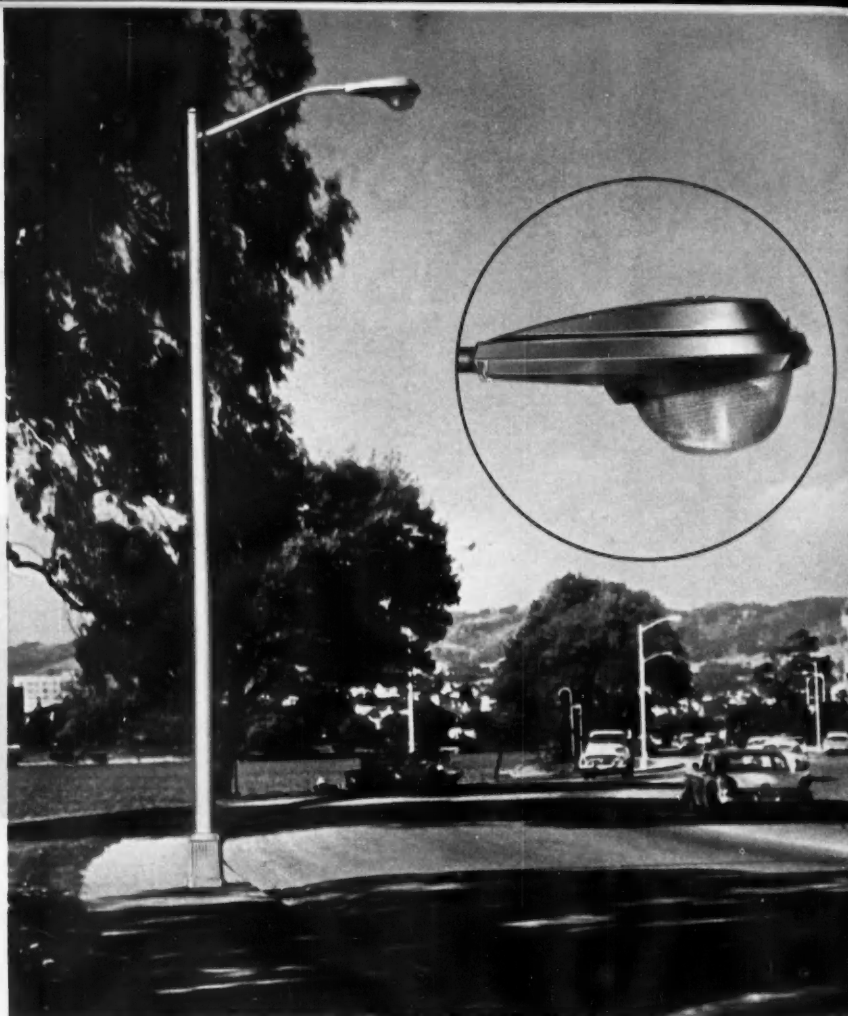
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**Industries**

McGRAW-EDISON COMPANY



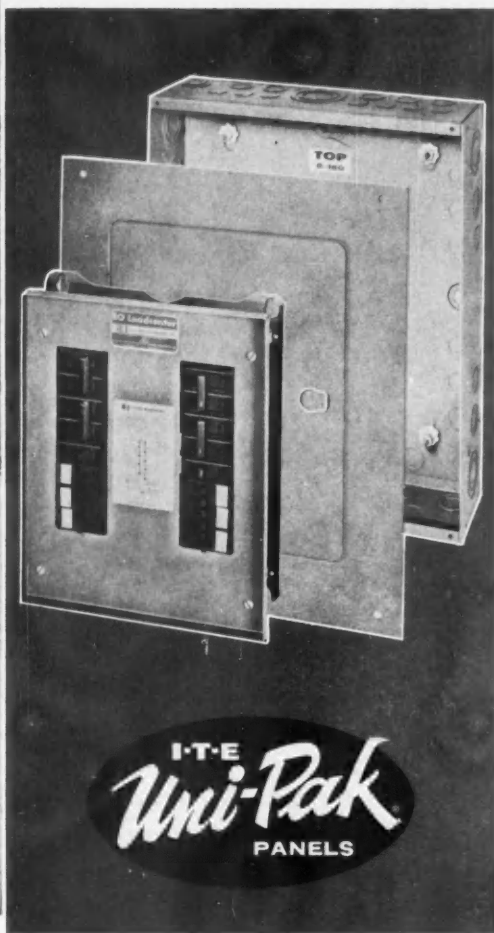
"BETTER LOOKING—BETTER LIGHTING"



DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUPS AND FUSE LINKS • LIGHTNING ARRESTERS  
CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

## Here are suggested applications

	Street Lighting "White Way"	Neighborhood	Tunnels Underpasses	Highways Toll Roads	Malls Public Parks	Hotels, Motels, Drive- In Restaurants	Amusement Parks, Swim- Pools, Playgrounds, Golf Courses, Marinas	Airport Roads Parking Lots	Shopping Centers Parking Lots	Used Car Lots Inst. Grounds, Hospitals	Schools, Clubs, Churches	School Playgrounds	Trailer Parks Resort Grounds	Rural— Farm Yards	Rural Roads	Industrial-RR Yards, Loading Docks	RR Station Platforms	Residential-Drive- ways
<b>STYLED MERCURIES</b>																		
Stylaire Single & Twin—Stylevue-Dyad	X			X	X	X	X	X	X	X	X	X	X			X		
<b>UNISTYLE MERCURY</b>	X	X		X			X		X	X		X				X	X	
<b>POST TOP LIGHTS (PTL's)</b>																		
StyleKing		X			X	X	X	X	X		X		X				X	
Stylette		X			X	X	X		X		X		X				X	X
<b>LAWN-GLO</b>																		
Contemporary Styles A, B, C—Traditional		X			X	X	X		X		X		X					X
<b>STYLED SUBURBANAIRE</b>																		
Mercury & Incandescent		X	X		X	X	X			X			X	X	X	X	X	



# I-T-E CIRCUIT BREAKER LOADCENTERS



*Specify I-T-E! Panelboard-type construction assures commercial quality in a residential product! And, separate Uni-Pak packaging speeds installation. First, you mount the 14 1/4" Uni-Pak box snugly between 16" stud centers . . . hang either fusible or breaker interior as you would a picture . . . add trim and job's done! You do not tie-up working capital if you buy the box, interior and trim separately to install separately. Write to I-T-E CIRCUIT BREAKER COMPANY, WALKER DIVISION, 125 Bennett Street, N. W., Atlanta 9, Georgia. Ask for the SPEEDFAX CATALOG.*

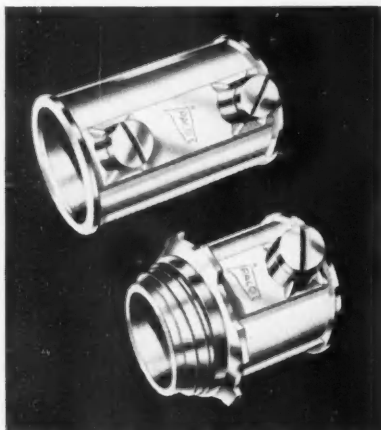
**for the contractor who is proud of his work!**



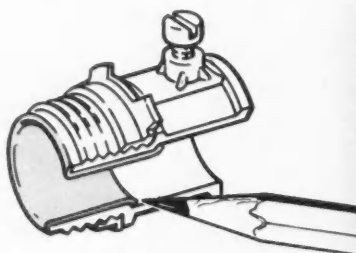
**I-T-E CIRCUIT BREAKER COMPANY**  
WALKER DIVISION



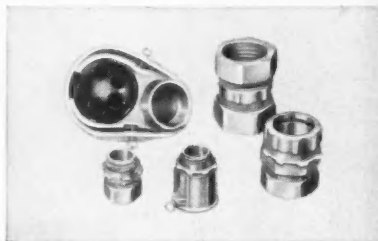
# NEW FROM RACO



**RACO E.M.T. Pressure Cast Set Screw Fittings with Staked Screws.** These rugged new fittings have staked screws that are flush with the inside. You never have to back off screws and the screws never fall out. Designed of top quality alloy. Concrete tight. Deep cut threads speed up installation. Connector and coupling available in five sizes  $\frac{1}{2}$ " to 2".  
UL Approved

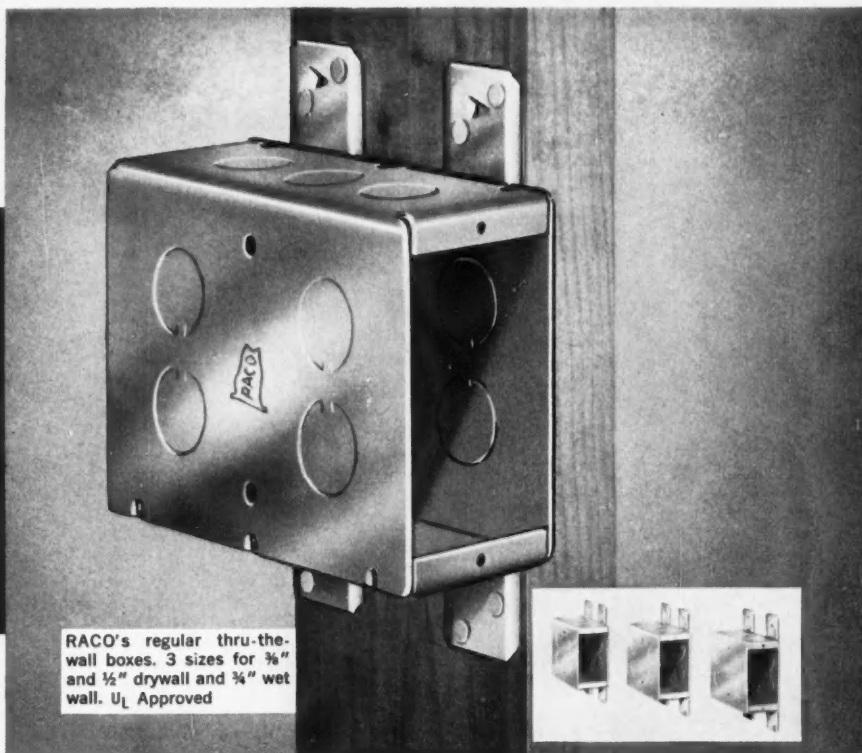


**E.M.T. Insulated Throat Set Screw Connector.** Cutaway above shows how RACO has rolled the insulated throat over the shoulder. This feature prevents throat from falling out, even with temperature changes. Eliminates the need for a separate plastic bushing. Available in six sizes  $\frac{1}{2}$ " to 2".  
UL Approved



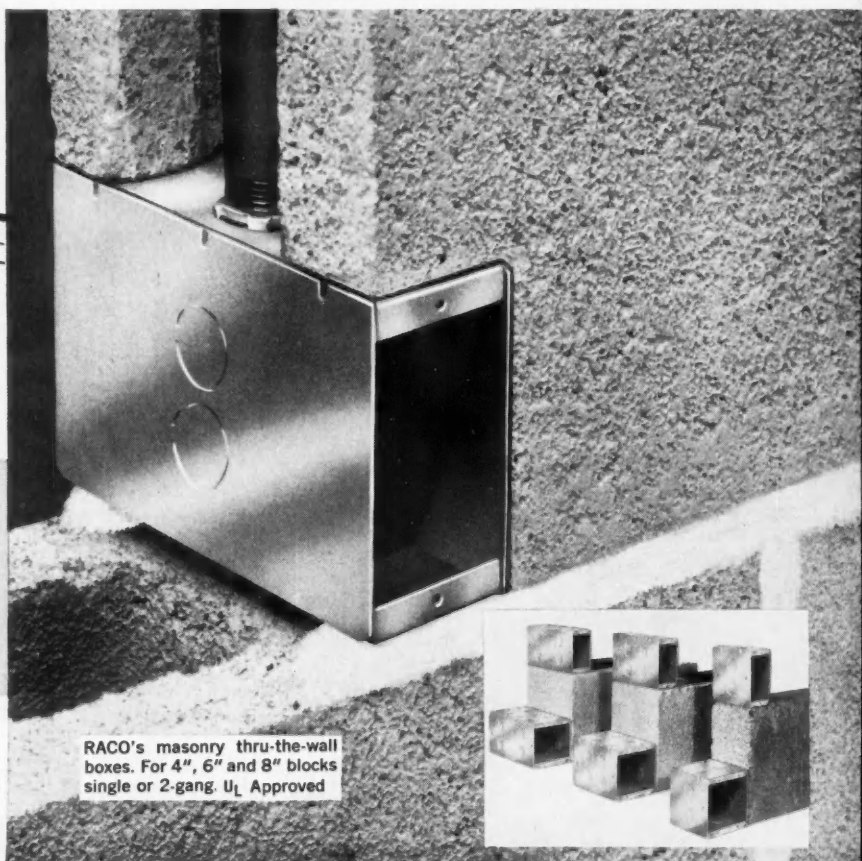
## FITTINGS For Every Need

- Rigid Conduit
- E.M.T. (Thinwall Conduit)
- Armored bushed cable, flexible metallic tubing and non-metallic cable
- Service entrances



**RACO's regular thru-the-wall boxes.** 3 sizes for  $\frac{1}{8}$ " and  $\frac{1}{2}$ " drywall and  $\frac{3}{4}$ " wet wall. UL Approved

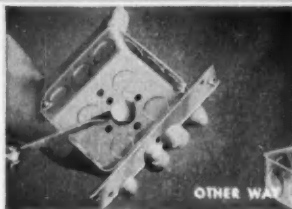
## Cut Costs with



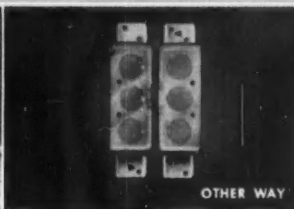
**RACO's masonry thru-the-wall boxes.** For 4", 6" and 8" blocks single or 2-gang. UL Approved



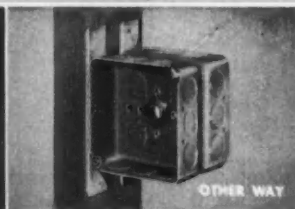
## REGULAR CONSTRUCTION **SAVE 50%**



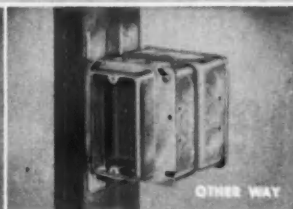
Above: Remove KO's on both 4" square boxes.



Above: Nipple two 4" boxes together, screw locknut on nipple and tighten.



Above: Nail two 4" boxes to studding.



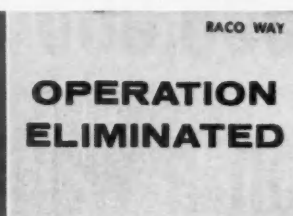
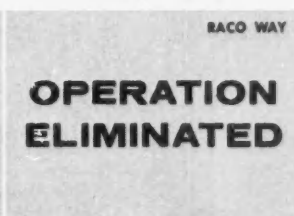
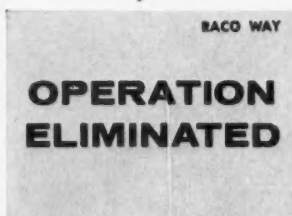
Above: Two 4" square covers put in place.

Below: Nothing to remove thus saving you installation time.

Below: No nipping and no locknut required. RACO saves you material and time.

Below: One RACO thru-the-wall box, with mounting bracket can be nailed to the stud quickly and easily.

Below: No covers needed, thus ... eliminating a costly operation.



## **RACO Thru-the-Wall Boxes**

## MASONRY CONSTRUCTION **SAVE 38%**



Above: An oversized irregular area must be cut in the block for two 4" boxes.



Above: Remove KO's from two 4" boxes.



Above: Nipple two 4" boxes together, screw locknut on nipple and tighten.



Above: Two plaster covers installed on boxes.



Above: Mudding around is a messy, time consuming job. Holes have to be retapped.

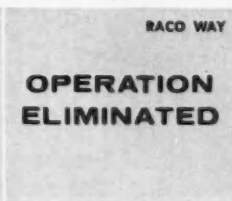
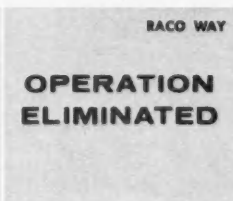
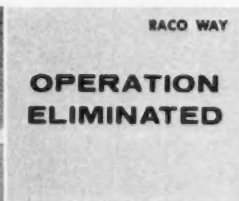
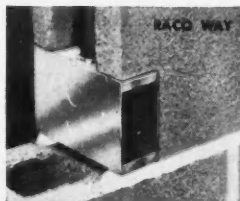
Below: Fitting square cornered RACO boxes require less work.

Below: Nothing to remove saving you time on-the-job.

Below: No nipping required eliminating costly labor and material.

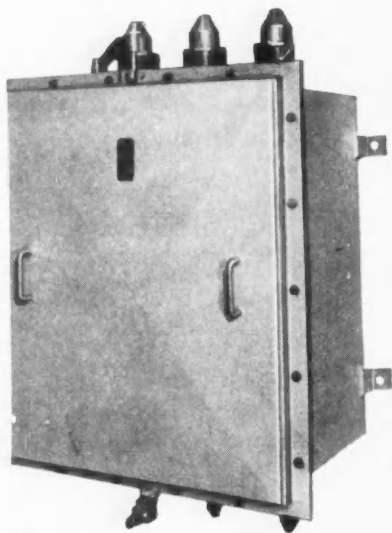
Below: No covers needed on RACO thru-the-wall boxes.

Below: RACO boxes give you a neater, faster job. Device holes are inside ... no retapping.



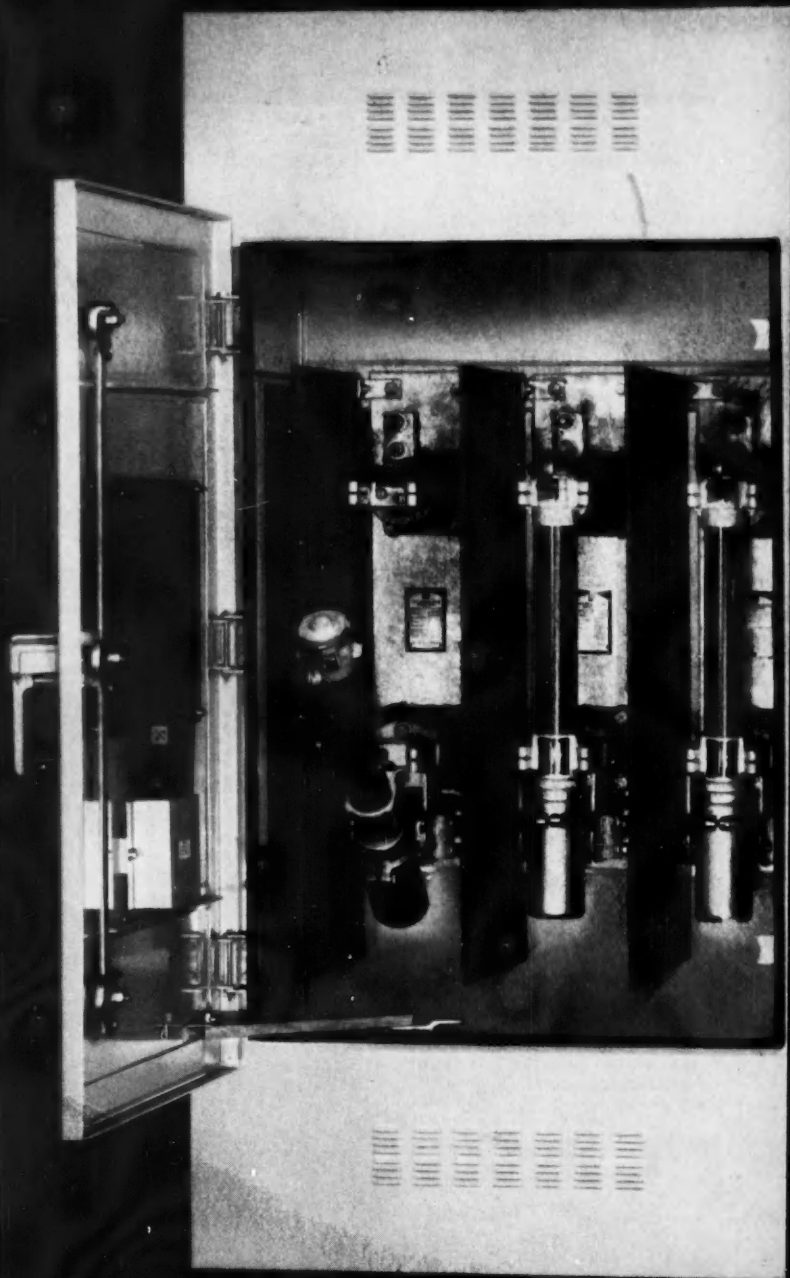
ALL-STEEL EQUIPMENT INC. Aurora, Illinois

**Who ever  
heard of  
hanging  
500,000 kva  
on a wall?**



▲ Submersible style for use in basements or vaults where flooding is a possibility.

► Indoor-outdoor style for general application where there is no possibility of flooding.





## Do it with S&C's new line of high-voltage metalclad fuses for wall mounting

Here is a steel-enclosed fuse that gives you economical and fully adequate high-voltage fault protection for small loads:

1. At service entrances;
2. On transformer primaries;
3. At underground sectionalizing points.

S&C's new line of metalclad fuses combines economy with high fault interrupting capability. Their compactness permits wall mounting, eliminating the floor area requirements of conventional free standing metalclad switchgear. And much less room height is needed.

These fuses are especially suited to applications that justify fault protection *only*—applications where infrequent load switching (and isolation for rare fuse replacement) may be done elsewhere.

To permit you to tailor the new S&C Metalclad Fuse—Type SM to your particular requirements, a complete selection of features and ratings is available:

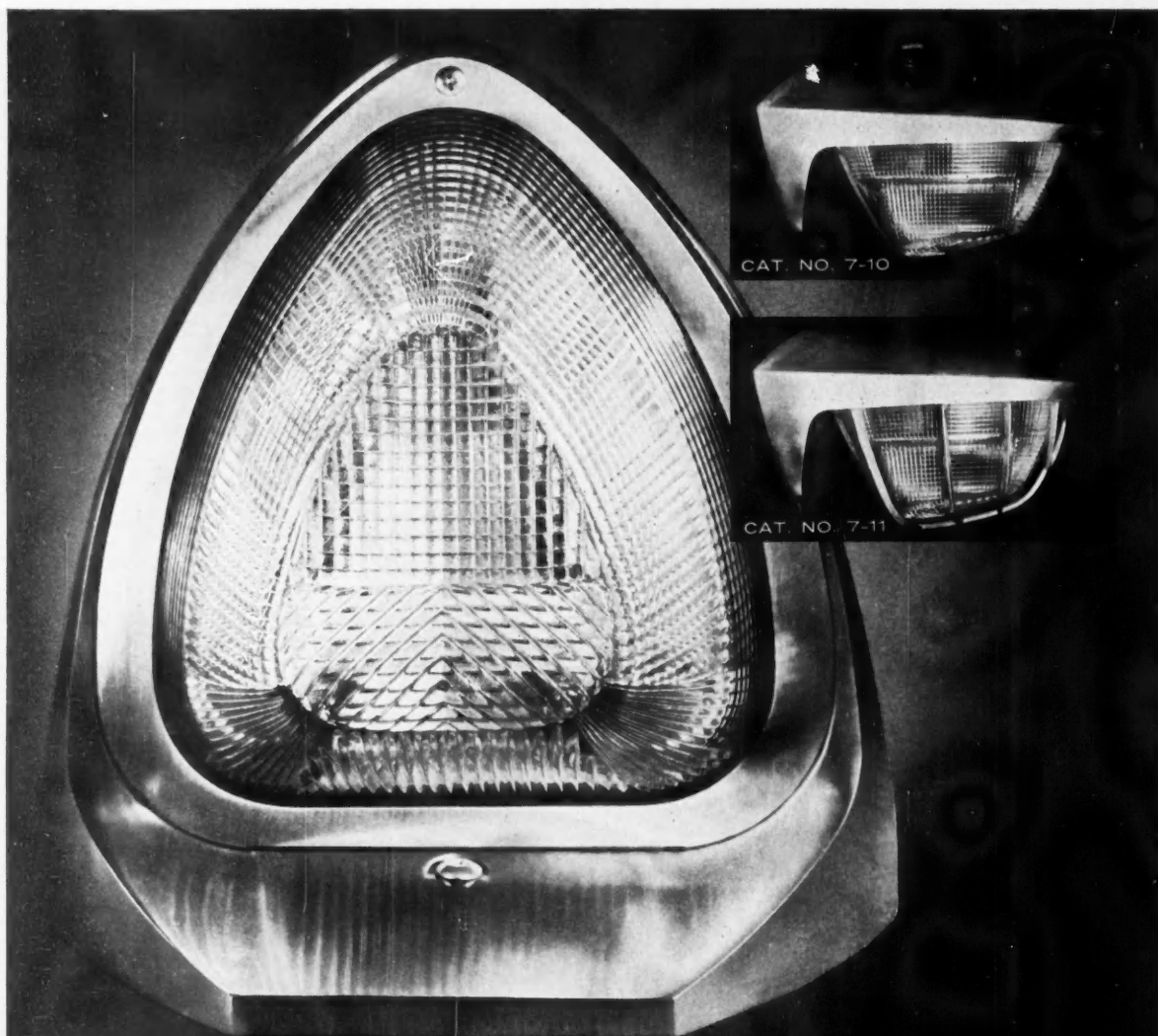
- Indoor Style, Indoor-Outdoor Style, or Submersible Style
- 4.8 kv or 14.4 kv
- 200E or 400E continuous amperes
- Cable entrance by knockout, flange-mounted pothead (1/C or 3/C), or integral pothead (1/C)
- 45,000 kva to 500,000 kva fault interrupting, in convenient steps

For further information, call your nearest S&C Sales Office. Consult the Yellow Pages under "Electrical Equipment" for the telephone number and address in all principal cities.

## S&C ELECTRIC COMPANY

6605 Ridge Boulevard • Chicago 26, Illinois  
Specialists in High Voltage Circuit Interruption since 1911





**new**

## **“DELTA-7” weathertight prismatic wall unit**

... universal in its application for outdoor lighting of Commercial, Institutional and Industrial Buildings

150 — 200 W. DESIGNER STYLED • EVERLASTING CAST ALUMINUM QUALITY, CORROSION RESISTANT, SATIN FINISH  
• ENCLOSED AND GASKETED FOR WEATHERTIGHT, VAPORTIGHT, BUG-TIGHT OPERATION • INTEGRAL CAST HINGE  
• HEAT RESISTANT, HIGH IMPACT, CORNING PYREX® ASYMMETRIC PRISMATIC REFRACTOR • AVAILABLE WITH OR WITHOUT INTEGRAL CAST ALUMINUM PROTECTIVE GUARD.

### **the mcPhilben way . . .**

... the original design of a highly efficient luminaire combined with Quality construction and enduring finish . . . resulting in a new visual experience.

“DELTA-7” exterior wall bracket is the newest expression of one half a century of

mcPhilben devotion to Superior Craftsmanship and unique, tasteful design. This meticulous attention to detail that must satisfy leading Architects and Engineers everywhere is what we call . . . the mcPhilben way.

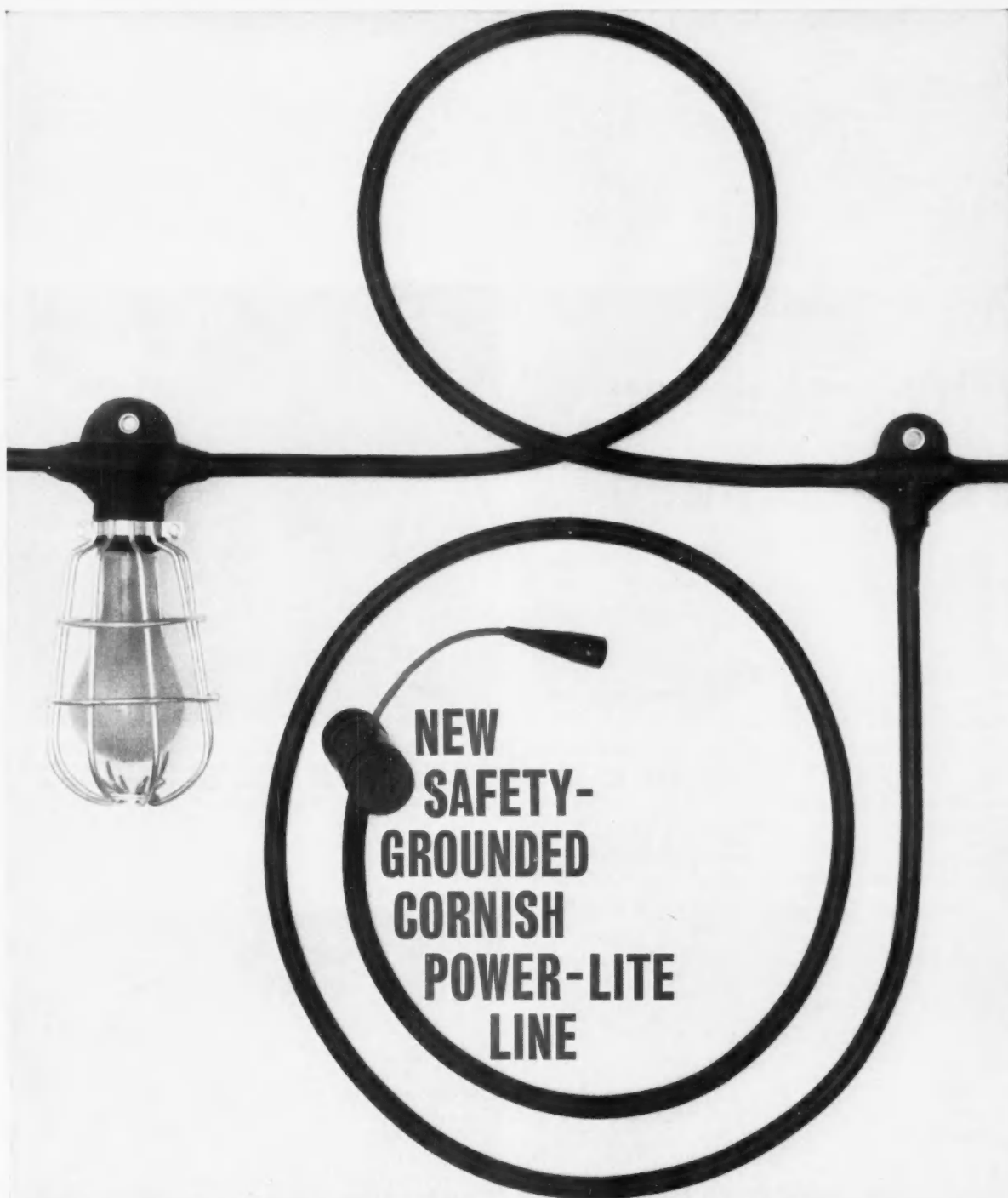


See this yourself . . . contact your mcPhilben Representative or write to us for complete specification data,

# **mcPhilben®**

1329 WILLOUGHBY AVENUE, BROOKLYN 37, NEW YORK





**FOR TEMPORARY LIGHT OR POWER—Be sure of total safety on every job—use grounded Cornish portable POWER-LITE LINE. Rated at 125 volts—15 amps, UL-approved POWER-LITE LINE has weatherproof, molded-on 3-conductor male and female connectors. Double-outlet plugs, too, have ground wire. Lamp outlets are molded with shade-holder grooves for guards or reflectors. Molded hangers make installation easy as driving a nail. Distributors are everywhere—coast to coast. See your phone book. □ Cornish Wire Co., 50 Church St., New York 7, N.Y.**



WESTINGHOUSE ASKED:

## "Why install more than you need?"

and modernization costs went down

Recommendations by Westinghouse saved money for both owner and contractor on the modernization of the 250-room Seneca Hotel, Columbus, Ohio.

The 47-year-old hotel had fallen behind the times when it was bought by Seneca Realty, Inc., in April, 1961. The newspaper story caught the eye of V. J. Weisenbach of Electric Power Equipment Company. Mr. Weisenbach, who works full-time on modernization business, promptly proceeded to sell modernization beginning with central air conditioning and the electrical distribution system.

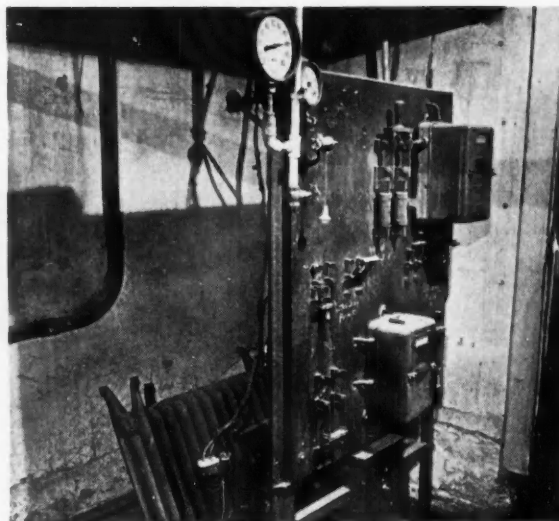
Westinghouse participated in the modernization, tailoring equipment recommendations to fit the job requirements. For example, original planning called for a 40-kw rectifier to supply power to the elevators. Westinghouse engineers analyzed the specs and suggested that a 25-kw unit would be more than adequate. On the regenerative control, tests were conducted to make sure this control was adequate for the installation.

Today, Seneca Realty, Inc., saves \$25,000 in maintenance and utility cost annually as a result of the modernization.

Westinghouse





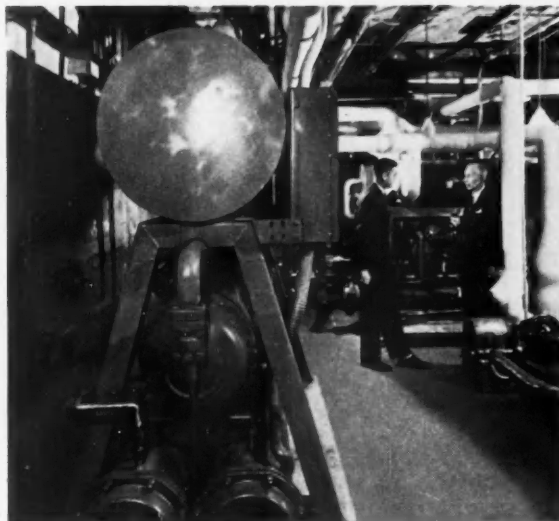
**Old.** Antiquated equipment in the boiler and mechanical room, before the modernization project. Almost inoperative equipment was worn, dirty, in some cases unsafe. Maintenance was extremely difficult and often costly.





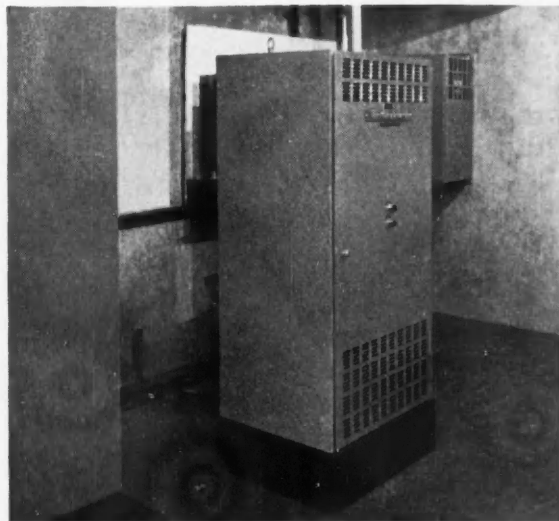
**Old.** The DC power for the hotel elevators was originally furnished by the utility. Switchboard open-live front was an obvious personnel hazard. Controls were susceptible to dust and dirt, requiring repeated maintenance.




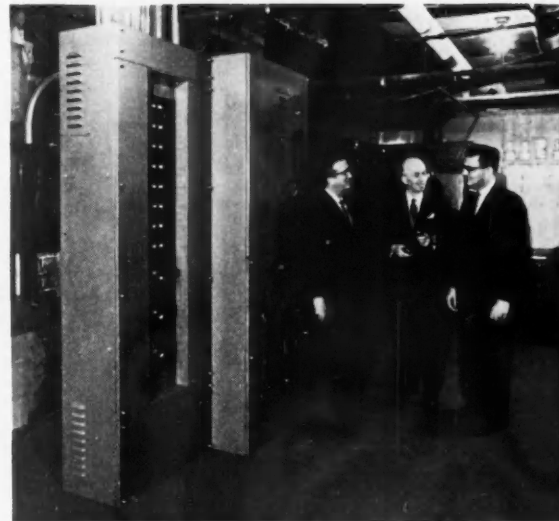
**New.** New  Motor Control equipment discussed by V. J. Weisenbach, Electric Power Equipment Co., and W. B. Mann,  Sales Engineer. Behind Mr. Mann is a new NQP Panelboard to feed lighting circuits. At right are size 1 Life Line<sup>®</sup> Starters that control pump and cooling motors.




**New.** Pictured are Mr. Sam Shuman, President, Julian Speer Co., Mechanical Contractor, and Herbert Tareyton, V. P., Seneca Realty, Inc. In left foreground is  PKB packaged water chiller providing air conditioning for every room of the Seneca Hotel. The unit is provided with a complete control panel, factory-wired and ready for connection. Large hotel guest room closets house  Series 1601 Air Distributing units, manufactured by the Sturtevant Division of Westinghouse.



**New.** With local utility discontinuing DC service, the economical answer was this  25-kw Silicon Rectifier furnishing Seneca elevators with DC power. The compact, fan-cooled unit is a maintenance-free static device. Regulation and control are automatic. The panel mounted on the wall behind the unit controls regenerative power for down elevators.



**New.** Messrs. Weisenbach, Tareyton and Mann stand alongside the new  Building-type Switchboard which handles incoming 120/208V power. This Series I Switchboard houses all protective devices in one dead front streamlined enclosure. The Distribution section feeds and protects auxiliary circuits in the equipment room.

J-94191

# THE VINYL TAPE FOR COLD JOBS



**NOW**  
in the exclusive **FLIP-n-CUT<sup>®</sup>**  
for easy operation in any weather!

- Needs no pocket warming at any temperature!
- All-weather—firm, strong and non-bleeding at high temperatures!
- Stays flexible at 14° below zero!
- Sticks and stays down even at 14° below!



**PLYMOUTH RUBBER COMPANY, INC.**  
QUALITY SINCE 1896 CANTON, MASSACHUSETTS

CW-3



# SAFETY

TO OPERATOR AND EQUIPMENT  
...against shorts up to 100,000 amps!



**TYPE SAHD**

Fusible only.

30—1200 amps. 240-v.—600-v.



**TYPE SCHD**

Fusible and non-fusible.

30—200 amps. 240-v.—600-v.

## FRANK ADAM HEAVY DUTY SAFETY SWITCHES

Proven in repeated tests without a failure—dependable, positive protection against 100,000 amp. shorts for both men and equipment. In addition, every switch is pre-shipment tested under loads double the rated voltage plus 1000!

**FRONT HANDLE OPERATION** allows side-by-side ganging; conserves all the space wasted by side-handle switches. Type SAHD can be FLUSH or surface mounted.

**QUICK-MAKE, QUICK-BREAK** Shutbrak mechanism

positively prevents arcing and pitting of main contacts.

**KAMKLAMP FUSE HOLDERS** lock fuse immovably in place; prevent overheating and burned fuses caused by loose contacts.

Interlocking hinged doors, wide-open access to interior for easier wiring, plus a host of other features make these heavy duty safety switches the industry's finest. Ask for new Bulletin 502.



**FRANK  
ADAM**

**ELECTRIC COMPANY**

P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO.

SINCE 1891

busduct • panelboards • switchboards • service equipment • safety switches • load centers • Quikmeter





# first switch- gear with static tripping



# up to now you couldn't get this much distribution protection

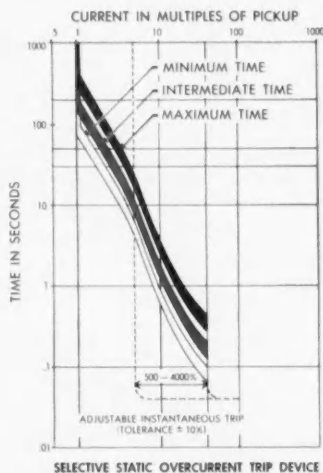
What happens when a fresh, creative approach is applied to the design of 600-volt, metal-enclosed switchgear?

Many improvements result . . . among them, the first application of static overcurrent tripping to switchgear. Means more accurate current sensing, faster response, greater reliability . . . all at no extra cost.

Now you have continuous adjustment throughout the complete current range of each element. Choose either of two static overcurrent trip devices. Dual static trip device combines the long-time element and the instantaneous element. Or the versatile selective static trip device where a higher degree of coordination (delayed fault tripping) is required.

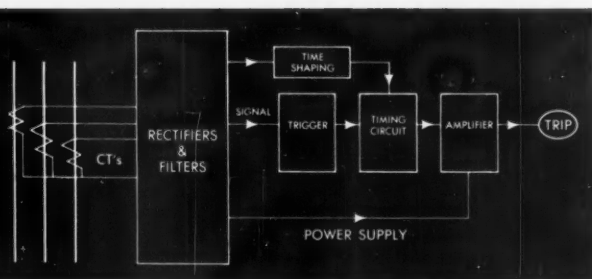
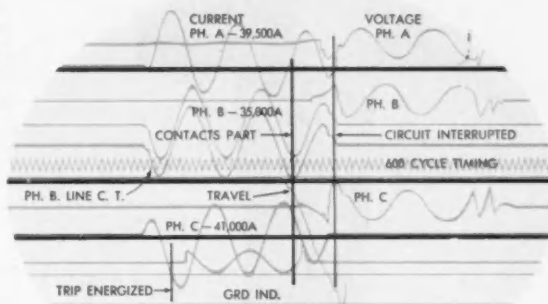
More A-C improvements: track-resistant, flame-retardant *Pyro-Shield* insulation is used throughout, coordinated to assure liberal creepage allowances. Breaker compartment located current transformers provide desirable front accessibility.

The new A-C 600-volt switchgear line is available in continuous current ratings through 4000 amperes and interrupting ratings through 150,000 amperes. *For more information, contact your nearby A-C representative or write Allis-Chalmers, Box 512, Milwaukee 1, Wisconsin.*



More functional time current characteristics and reduced band widths permit better integration into the overall protective scheme.

Typical test oscillogram shows the outstanding performance of LA-600, 25,000-amp interrupting capacity breakers.



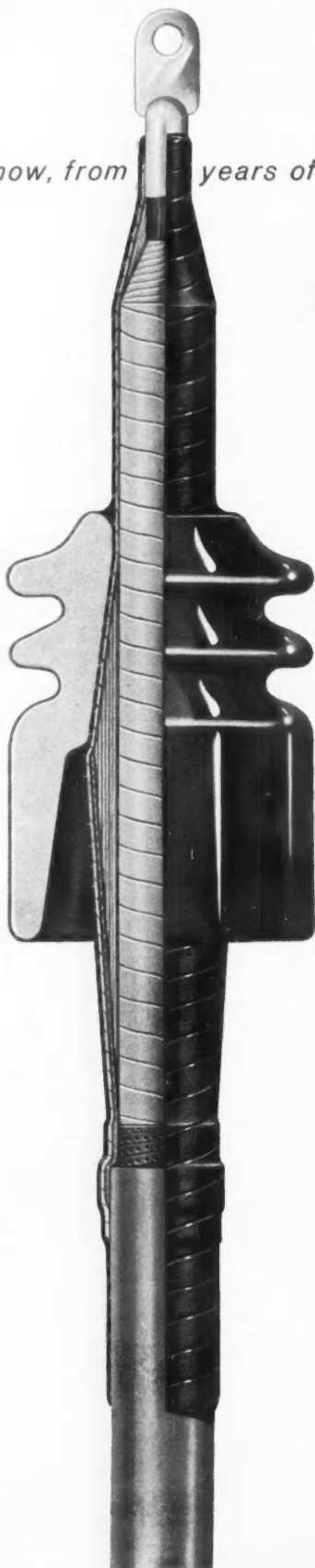
Simplified block diagram of low energy static overcurrent trip system.

## ALLIS-CHALMERS

*Pyro-Shield* is an Allis-Chalmers trademark.

A-1664

now, from years of G&W design, development, and testing...



# TERMETTES<sup>†</sup>

**offer low-cost  
cable terminations  
up to 15kv!**

You have the same assurance of cable termination dependability found in all G&W products with these proven features of TERMETTES:

- \* High Dielectric Strength
- \* Low Porosity
- \* Improved Track Resistance
- \* Resistant to Ultra-Violet Radiation
- \* Long Life

TERMETTES are available for single and multi-conductor applications — paper, varnished cambric, rubber, polyethylene, or any synthetic insulated non-pressure type cable rated 15kv or below with either synthetic jacket or metallic sheath. TERMETTE KITS include insulating tape, shielding braid, terminal lug and G&W's thoroughly tested combination of glass tape and specially formulated epoxy resin.

TERMETTES are easy to install; no external heat required for curing. Kits eliminate stocking problems, waste, material shortages and are ready-to-go-on-the-job. Ask your G&W representative for TERMETTE facts, or write for your copy of G&W Catalog CA1-A1.

OUTDOOR TERMETTE KITS, 7.5 and 15kv, include a PORCELAIN SHIELD . . . that surrounds the termination. Tracking resistance is materially improved and leakage currents minimized through use of the inorganic shield.



## **G & W ELECTRIC SPECIALTY COMPANY**

3500 WEST 127TH STREET • BLUE ISLAND, ILLINOIS  
Canadian Mfr. • Powerlite Devices, Ltd. • Toronto, Montreal & Vancouver

*superior quality standards — inspired specialized design*

Patent Pending

†Registration Applied For

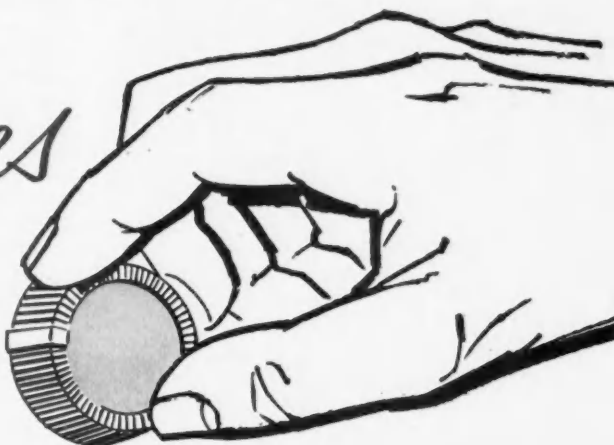
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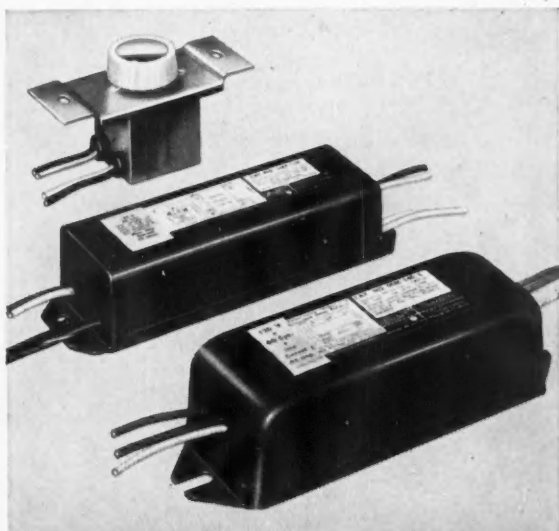
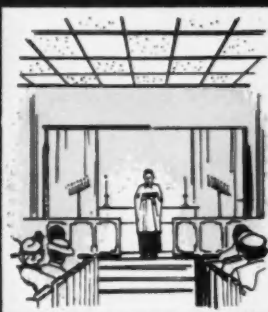
# ADVANCE TRANSFORMER CO.

## Announces

**THE MOST EFFICIENT  
AND VERSATILE  
FLUORESCENT LIGHTING  
DIMMING SYSTEM**



FOR STORES, RESTAURANTS, SCHOOLROOMS, AUDITORIUMS, CHURCHES, INDUSTRIAL PLANTS, RESIDENTIAL INTERIORS, ETC.



### 95% rated Lamp Output

### Dimming Ratio over 500 to 1

ADVANCE TRANSFORMER CO.'s new Fluorescent Dimming System is the most versatile and efficient system ever offered to the lighting industry. Because of its high efficiency and perfect dimming characteristics, this new system is the first to make fluorescent dimming practical for use in commercial as well as residential interiors. Unlike other fluorescent dimming systems which operate at reduced wattage and provide only 50% of the rated lamp output . . . the new Advance Fluorescent Dimming System operates at 95% of the rated lamp output with a 500 to 1 dimming ratio.

The Advance Fluorescent Dimming System incorporates two solid state semi-conductors in its auxiliary and permits 12, 40-watt Rapid Start Lamps to be operated at full brightness from one dimming auxiliary. Contact your Advance Representative or write for Bulletin No. 1227.



## REALLY TOOK HOLD!

The number of qualified powder actuated tool operators has increased one thousand times — from 250 to 250,000 — in the last 15 years. Powder actuated tools play a vital role in helping America build up to meet ever-increasing needs.

Why this growth? Powder actuated tools have caught on because they hold fast. For example, penetrated steel provides a vise-like grip on the fastener shank, produces tremendous holding power. Tensile loads up to 10,800 pounds have been required to withdraw a .250 inch diameter fastener shank from  $\frac{3}{4}$ " structural steel. Completely mobile, self-contained, light weight powder actuated tools fasten steel to concrete, wood to concrete, steel to steel instantly, easily — with unmatched holding power.

Use coupon below — get your free portfolio of current information provided by the Powder Actuated Tool Manufacturers Institute.

To: Powder Actuated Tool Manufacturers Institute, Inc. ECM10  
 200 College Street, New Haven 10, Connecticut  
 Please send me information on powder actuated tool fastening.  
 NAME \_\_\_\_\_ TITLE \_\_\_\_\_  
 COMPANY \_\_\_\_\_  
 ADDRESS \_\_\_\_\_  
 CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_  
 No representative will call, unless you so request.



For the best in powder actuated tool fastening, rely on these brand names of member companies:  
**NELSON / OMARK / RAMSET / REMINGTON / STAR**

# How to determine proper Control Run for Remote Control Switches

With remote control switches (as with any electromagnetically operated device), it is absolutely essential that maximum allowable run for each switch should not be exceeded.

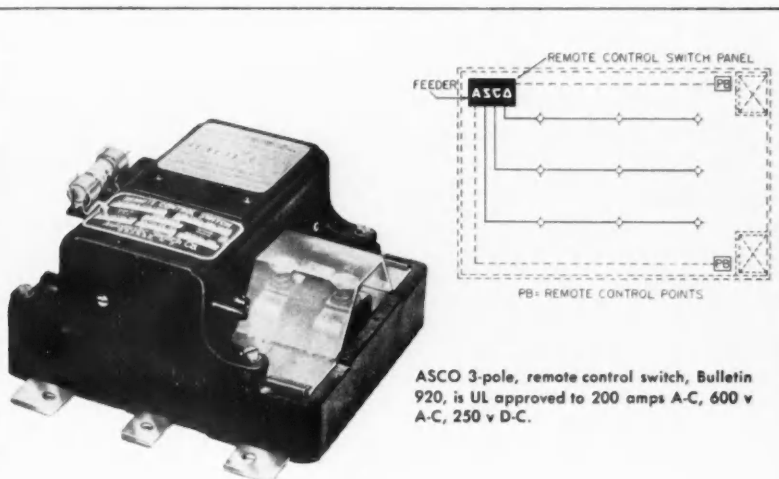
Here is a handy guide to help you determine admissible distances between switch and remotely located control station:

1. Doubling the control voltage will increase the allowable run with the same size of wire by about 4 times.
2. Doubling the cross sectional area of the control conductors will increase the allowable control run by 2 times. The cross sectional area of a conductor will approximately double with three gauge number sizes larger wire. Thus #14 has approximately double the area of #17, and one-half the resistance per unit length.
3. Full consideration should be given to the use of auxiliary relay control for remote control switches, particularly for group installations requiring master control and for extremely long runs.

The following tabular data specify maximum distance between control station and one Bulletin 920 switch with source line voltage at 90% of normal. Similar charts are available on the range of ASCO "remotes."

AMPERES	B&S GAUGE	DISTANCE IN FEET	
		110 V. 60 CYS.*	220 V. 60 CYS.*
30,60,75	14	550	1600
	12	900	2600
	10	1400	4200
100,150,200	14	325	1200
	12	500	1900
	10	800	3000

\*For 208 volt system, reduce 220 volt values by 30%.



ASCO 3-pole, remote control switch, Bulletin 920, is UL approved to 200 amps A-C, 600 v A-C, 250 v D-C.

## Why Mechanically Held

A remote control switch is essentially a feeder disconnect switch. Consequently, it is usually installed in a lighting or power distribution panel feeding numerous circuits. In function the disconnect switch used should operate just like the manually operated type of disconnect switch—it should be unaffected by line voltage conditions and should respond only to the control of the push buttons.

Only a mechanically held switch can meet these requirements. Mag-

netically held contactors, which open on momentary line voltage dips and control circuit derangements, introduce the hazard of complete outage on vital circuits until repairs can be made.

ASCO Mechanically Held Remote Control Switches are unaffected by line voltage conditions; each switch includes a manual operating knob or handle so that the switches can be operated manually at any time.

The values for control run listed are for one switch. For installations involving more than one remote control switch connected to the same control conductors, the values listed can be considered as switch-feet. The allowable run for group installations will be equal to the listed values divided by the number of remote control switches operating from the same control conductors. Thus, if one switch has an allowable run of 100

feet with #14 wire, ten switches will be limited to 10 feet. When switches are located along a transmission control line, calculations in terms of switch-feet will produce the solution.

## Dependable control by ASCO

New catalog 57-S2 on ASCO Remote Control Switches is now available. Write today for this basic reference on dependable electromagnetic control.

# ASCO Electromagnetic Control

# ASCO

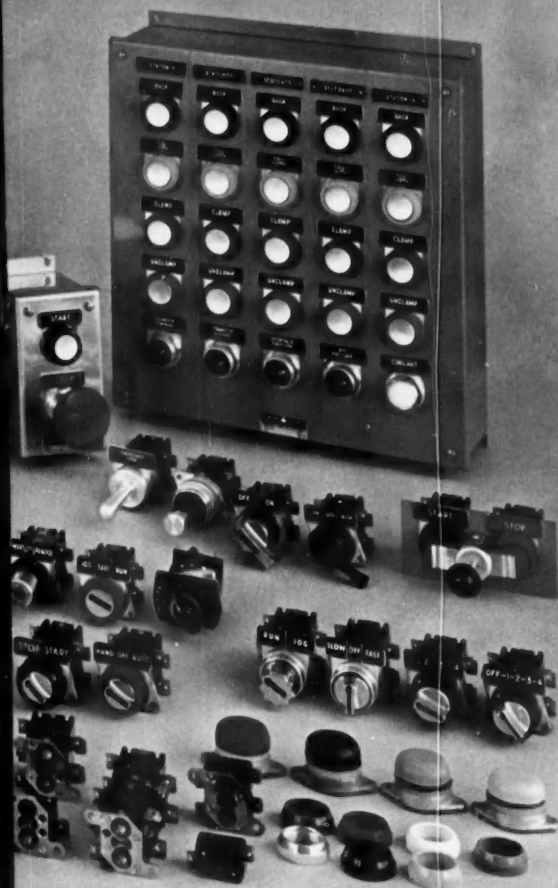
DEPENDABLE CONTROL BY Automatic Switch Co. 50-J HAMOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4600 • AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL



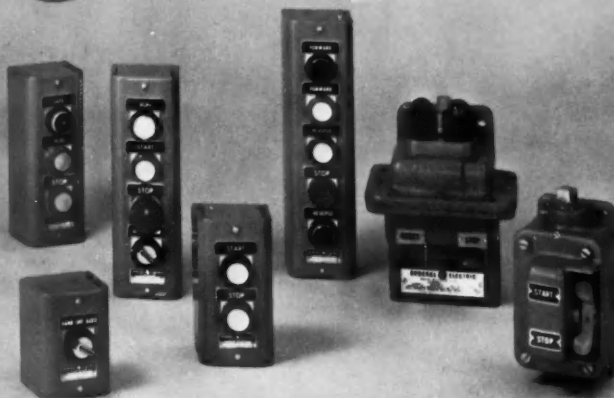




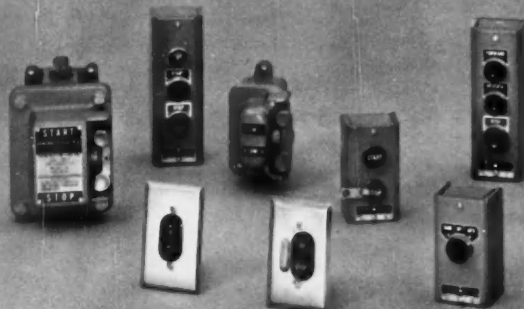
*Leader in...*  
CONTROL INNOVATION



**PUSHBUTTON LINE**



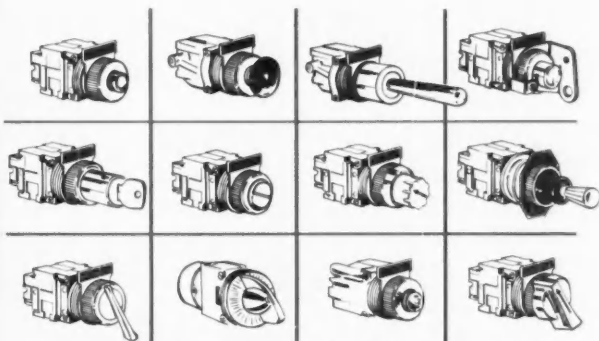
**NEW HEAVY-DUTY PUSHBUTTON LINE**



**STANDARD-DUTY PUSHBUTTON LINE**

## Selection Flexibility With Miniature Oil-tight Line

**CHOOSE FROM 20 DIFFERENT UNITS . . .**  
(A Few Illustrated Below)



**SEPARATE CONTACT BLOCKS, COLOR RINGS AND CAPS . . .**



**TO GET HUNDREDS OF DIFFERENT COMBINATIONS**

General Electric miniature oil-tight units increase appearance and selection flexibility—cut inventory costs at the same time.

By stocking a few complete units and components (operators, rings, contact blocks), you can combine them to build whatever units you require. You need only a minimum stock of each.

Choose from twenty different types of units—push buttons, selector switches, and illuminated forms. Rings for most operators are available in six permanent colors (black, red, yellow, green, white and blue) or bright metal. Use them to color code your panels for appearance and increased operator efficiency.

Contact blocks feature quick-connect terminals that save you wiring time, accommodate #12-22 wire. Miniature oil-tight forms are available with 1NO-1NC and 2NO-2NC contact arrangements.

A wide variety of flush- and surface-mounted enclosures adds further flexibility. Cast-aluminum stations are available with up to 42 units; stainless- and sheet-steel enclosures accommodate up to 56 units; pendent stations are offered for up to 30 units.

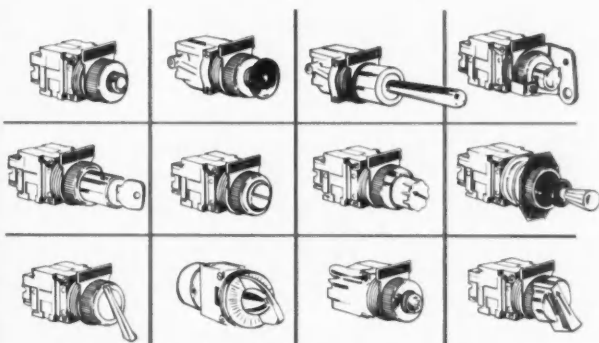
**For information on General Electric heavy-duty oil-tight push buttons, see next page.**



# Selection Flexibility With Miniature Oil-tight Line

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(A Few Illustrated Below)



## SEPARATE CONTACT BLOCKS, COLOR RINGS AND CAPS . . .



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A wide variety of flush- and surface-mounted enclosures adds further flexibility. Cast-aluminum stations are available with up to 42 units; stainless- and sheet-steel enclosures accommodate up to 56 units; pendent stations are offered for up to 30 units.

For information on General Electric heavy-duty oil-tight push buttons, see next page.

## Heavy-duty Oil-tight Line Provides Single- And Double-

General Electric's heavy-duty oil-tight line gives you the choice of single- or double-circuit contact blocks, plus a wide variety of versatile operators.

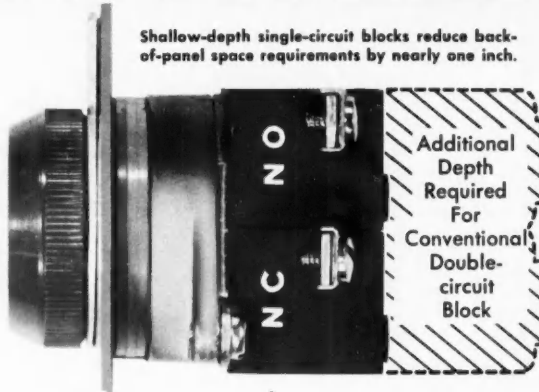
Rated 10 amps carry 600 volts max., 60 amps make and break at 110-125 volts a-c, heavy-duty oil-tight units can be used with contactors and starters through NEMA Size 5. High-quality units are built to last under rough duty-cycle START, STOP, REVERSE and JOGGING operations. They can be used in normal atmospheres and where oil, water, coolants and other contaminants are present.

Choose the contact block—single- or double-circuit—that meets your application. With G-E single-circuit blocks, you can buy only the circuits you need. No paying for unused circuits. Just stock 1NO or 1NC blocks and build up the exact circuits required. You can assemble any of 44 combinations of normally open and normally closed contacts, including 8NO or 8NC contacts.

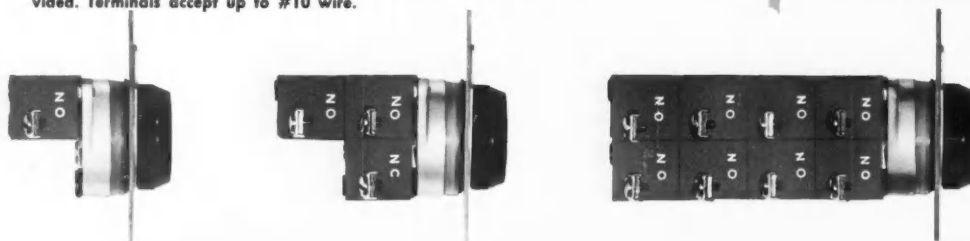
If circuits must be added, just add the required extra blocks—no disassembly necessary.

Double-circuit contact blocks (1NO-1NC) are available for single, double or tandem mounting. Up to 4NO-4NC contacts can be provided. Terminals accept up to #10 wire.

Shallow-depth single-circuit blocks reduce back-of-panel space requirements by nearly one inch.



ACTUAL SIZE





## circuit Flexibility With Wide Variety Of Operators

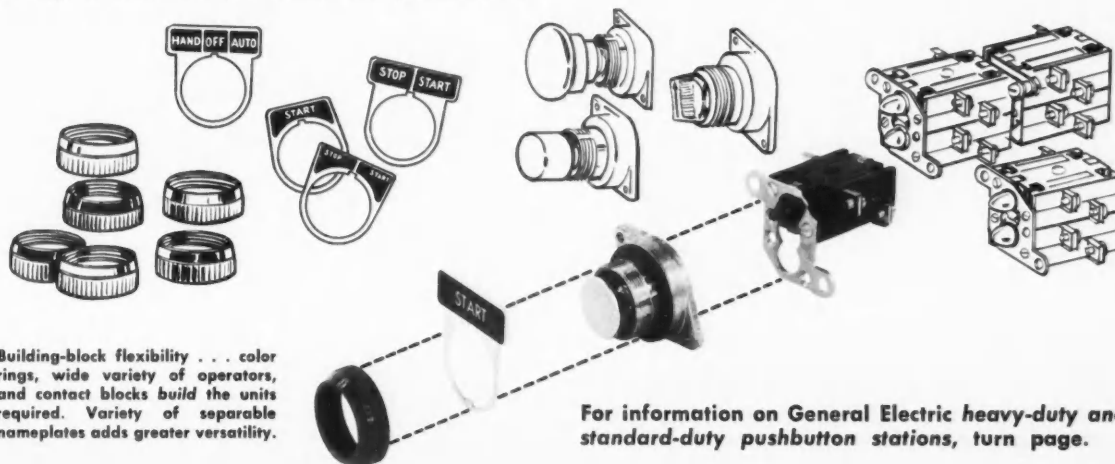
Heavy-duty oil-tight push buttons provide building-block flexibility with a wide variety of operators.

By stocking various pushbutton operators, rings and contact blocks, you can build the exact units required.

Choose from twenty-six different types of push buttons, selector switches, and illuminated forms. Separable rings are available in six permanent colors. Combine operators and rings to color code your panels for appearance and

increased operator efficiency. A large selection of nameplates helps identify each function controlled.

A wide variety of flush- and surface-mounted enclosures brings further flexibility. Cast-aluminum stations accept up to 16 units; stainless- and sheet-steel enclosures are available for up to 25 units; and pendent stations are offered for up to 10 units.



Building-block flexibility . . . color rings, wide variety of operators, and contact blocks build the units required. Variety of separable nameplates adds greater versatility.

For information on General Electric heavy-duty and standard-duty pushbutton stations, turn page.

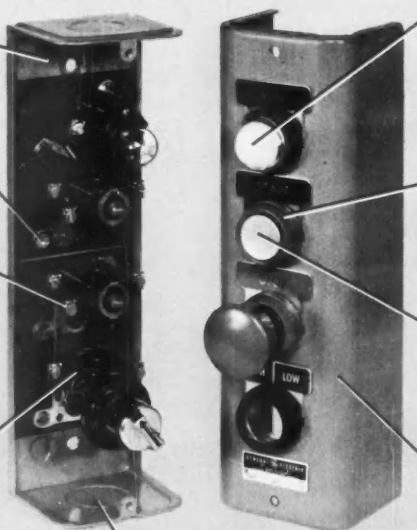
## NEW Heavy-duty Line With Color-coding Flexibility

180° accessibility facilitates wiring, inspection and maintenance.

Back-mounted contact blocks permit easy connections.

Front-accessible, saddle-clamp terminals and pan head screws speed wiring, take up to #10 wire.

Double-break silver contacts for positive make and break.



Conduit knockouts on top, bottom, and back allow wiring from any direction.

Lens for indicating light in six colors.

Rings available in red, black, yellow, green, white and blue.

Buttons are easy-to-operate even with a gloved hand.

Heavy steel case for rugged use.

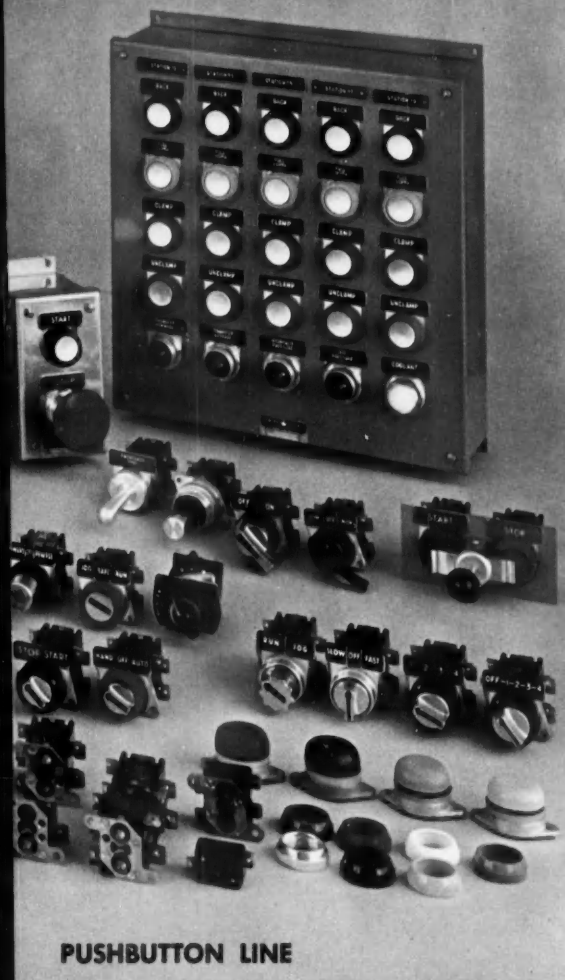
New General Electric heavy-duty pushbutton stations combine a variety of operators and color-coded rings for rugged START, STOP, REVERSE and JOGGING operations.

Rated 10 amps carry 600 volts max., 60 amps make and break at 110-125 volts a-c, new heavy-duty units are used with starters and contactors through NEMA Size 5.

Operators include a choice of push-button forms, selector switches and illuminated units. Rings are available in six colors to color-code functions handled by each operator.

Stations with up to six operators are available in NEMA Type 1 general-purpose, surface-mounted enclosures.

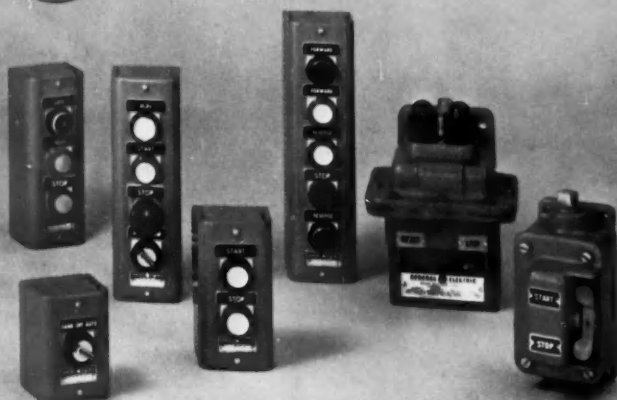
Dust- and watertight stations offer up to four units; Class I, Group D or Class II, Group G explosion-proof enclosures have up to three units and two indicating lights. In addition, palm- or foot-operated surface-mounted stations are also available.



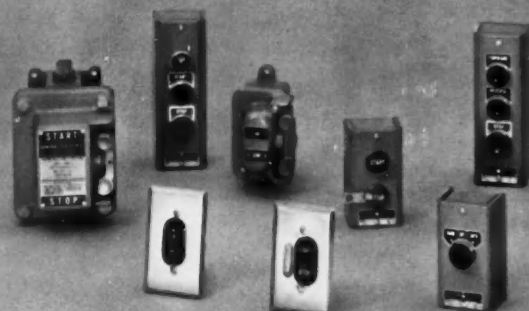
**PUSHBUTTON LINE**



*Leader in...*  
**CONTROL INNOVATION**



**NEW HEAVY-DUTY PUSHBUTTON LINE**



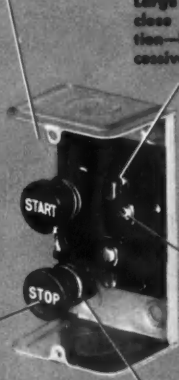
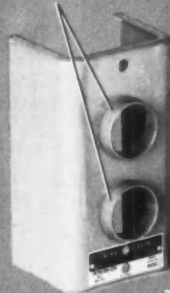
**STANDARD-DUTY PUSHBUTTON LINE**

## Standard-duty Stations For Economical Operations

Raised guard rings help prevent accidental operation.

180° accessibility simplifies wiring, inspection and maintenance.

Large silver contacts close with rolling action—help prevent excessive arcing.



Extra-long, front-accessible terminal screws take up to #12 wire.

Concave buttons, easy to actuate—even with gloved hand.

Strong contact springs prevent accidental closure from machine vibration.

General Electric standard-duty stations offer dependable economical control for all normal **START-STOP** or **REVERSE** operations.

Rated 10 amps carry 600 volts max., 30 amps make and break at 110–125 volts a-c, standard-duty push buttons are used with starters and contactors through NEMA Size 4.

Stations are available in general-purpose, surface-mounted enclosures with up to three units; stainless-steel flush plates with up to three units; dust- and watertight stations, and Class I, Group D and Class II, Groups E, F and G explosion-proof stations with one or two units. Operators include push buttons, selector switches and indicating lights.



For complete information on General Electric's four push-button lines, contact your G-E Salesman or nearest G-E Distributor—he stocks a complete line of General Electric Control; or write for Publication GEA-7348, to: Section 811-37, General Electric Company, Schenectady, New York.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**



## THE RUSSELL INDUSTRIAL CENTER 2 MILLION SQ. FT. OF INDUSTRY Electrically Heated Where Heat's Critical

Electrical Contractor  
Van Norman Electric Co., Inc.

Electric Heating Specialist  
Robert V. Pollock, Detroit Edison Co.

**® Electromode** heat, an integral part of the remodeling of the Murray Corporation buildings, is helping to make them a valuable property again. Abandoned and inactive when the Murray Corporation moved out, 60 per cent of the two million square foot complex is now leased—bustling and busy, as the Russell Industrial Center. The unmatched comfort of electric heat used in the Center increases employee productivity. This, and the advantages of low maintenance, reduced space requirements and high safety have made electric heat a key sales point in bringing the buildings back to life. The illustrations show Electromode is installed from the roof (14 elevator penthouses) to the basement, and in much of the space between. The present large and growing occupancy of the Center proves it was a wise decision.

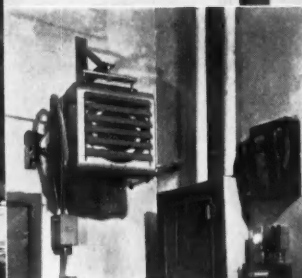
To prevent elevator machinery from freezing up, yet without wasting heat on unused space, the Russell Industrial Center's 14 elevator penthouses are equipped with Electromode Quartz-one Tube Heaters, as illustrated.



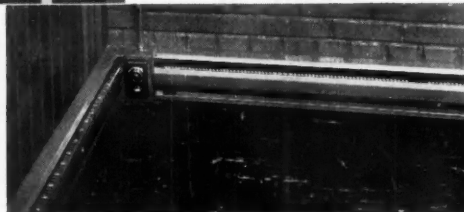
Another Russell Industrial Center tenant, the Feetwing Corporation, receives fan-circulated comfort from Electromode surface mounted Down-Flo Wall Units.



Office of the Gates Rubber Company, a Russell Industrial Center tenant. Note trim, space-saving design of Electromode Low-Level Baseboard Units.



Stairwells and corridors throughout the Russell Industrial Center are heated with Electromode Suspension Heaters, for Completely uniform heat distribution.



The photo shows an Electromode thermostat as it appears on an Electromode Baseboard Unit installation in the Russell Industrial Center. These precision controls are also available in tamper-proof models, if required.

**® Electromode**

Division of Commercial Controls Corporation  
Dept. ECM-102

ROCHESTER 3, N. Y.

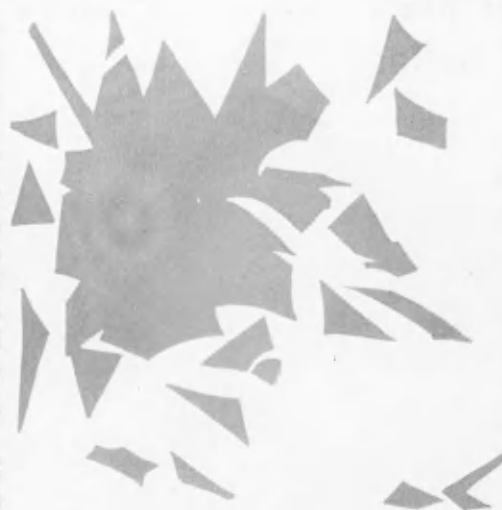




First used on Cape Canaveral...Pyle-National introduces the first and *only* Class I, Group B, 500 Watt Quartz-Iodine Floodlight. For use primarily in locations containing hydrogen, this new floodlight is weather resistant and raintight, has heat and impact resisting plate glass face, universal adjustment, exclusive reflector design and compact size. The quality of Quartz-Iodine lamps are ideal where correct color rendition is essential to TV pickup.

## **THE ONLY GROUP B**

**EXPLOSION-PROOF**



**EXPLOSION-PROOF**

## **CLASS I FLOODLIGHT**

Pyle-National offers the complete line of both Group B and general explosion-proof lighting and electrical equipment. Write for Pylet catalog information.

THE PYLE-NATIONAL COMPANY, 1344 N. KOSTNER AVE., CHICAGO 51, ILLINOIS • ALSO MANUFACTURED IN CANADA BY: PYLE-NATIONAL (CANADA) LTD., CLARKSON, ONT.



**THE PYLE-NATIONAL COMPANY**

**This emblem  
means real  
advantages  
to you**

**... on a  
lighting  
fixture  
ballast**

**CBM  
CERTIFIED  
by  
ETL**



- 1. Longer lamp life** . . . up to 12 months longer
- 2. Longer ballast life** . . . long trouble-free operation under normal conditions
- 3. Positive starting** . . . plus power factor correction, UL listing
- 4. Full light output** . . . assures rated light from fluorescent lamps

... these practical advantages and others grow out of *specified performance*. Certified CBM Ballasts are pro-

duced by leading manufacturers to meet rigid specifications . . . set by ASA and checked by Electrical Testing Laboratories. Good reasons why it pays to be sure of Certified CBM Ballasts in fluorescent fixtures that you specify or install. For helpful news and facts on ballasts, ask us to send you CBM News.

**CERTIFIED BALLAST MANUFACTURERS**

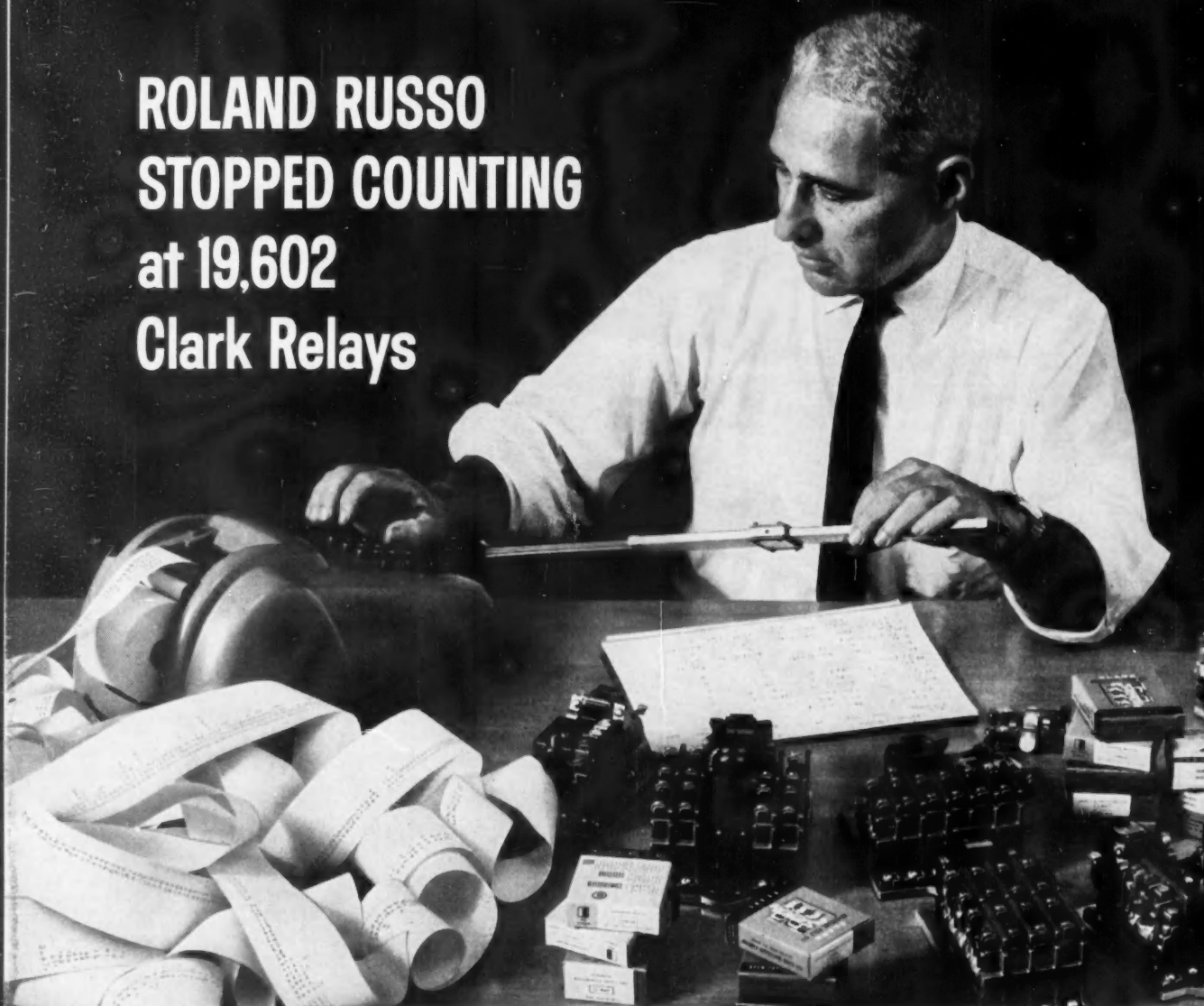
2116 Keith Building, Cleveland 15, Ohio

Participation in CBM is open to any manufacturer who wishes to qualify.

1-62



# ROLAND RUSSO STOPPED COUNTING at 19,602 Clark Relays



Talk about versatility! We haven't seen a problem in relay circuitry that the seven basic relays and 32 conversion kits in the Clark PM Relay line couldn't handle.

Roland Russo, our relay engineering expert, launched his very own count-down to figure the total variations possible. "Stopped at 19,602," says he. "Figured that was enough to prove our point!"

Choose Clark PM Relays, and you get the exact control you need, most economically. With a few basic relays and a small stock of Clark Conversion Kits, you have at your fingertips general purpose, latch and time-delay relays with literally thousands of different circuit arrangements. And, it takes only seconds to convert from one circuit arrangement to another, even after the relay is mounted and wired.

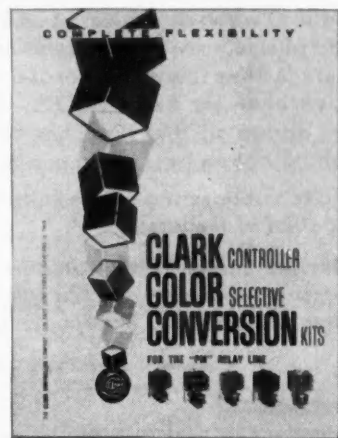
Compare all makes with Clark when you buy or replace controls. Compare for quality, flexibility, ease of installation and servicing—for design features that save time, trouble and money.

And, compare price. Clark controls cost no more.

62R2

**THE CLARK CONTROLLER COMPANY**

MAIN PLANT: CLEVELAND, 10 • WESTERN PLANT: LOS ANGELES, 58  
IN CANADA: CANADIAN CONTROLLERS, LIMITED, TORONTO, ONT.

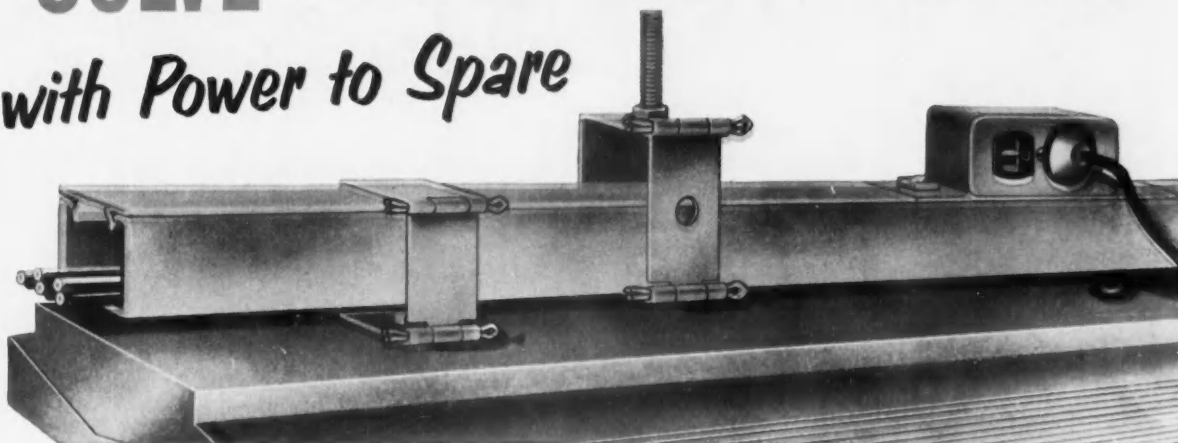


**SEE FOR YOURSELF** by sending for this color-coded relay conversion chart. It demonstrates the amazing versatility of the Clark PM Relay line. It's free. Simply request on your letterhead.



# SOLVE FIXTURE HANGING PROBLEMS

*with Power to Spare*



## STEEL CITY CHANNEL MOUNTS, HANGS and FEEDS THE FIXTURES

### POWER TO SPARE—

A central wiring distribution channel with conductor capacity that exceeds requirements of any lighting layout and with power to spare for other uses. Here's a Channel that adapts to any interval of structural support—may be dropped to any level where it becomes a rigid platform for fixture attachment. Lighting fixtures may be spaced and fastened anywhere along the Channel System.

Branch lighting circuit conductors are completely enclosed in Channel from panel to fixture. This raceway carries full Underwriters' Laboratories, Inc. approval.

### STEEL CITY CHANNELS

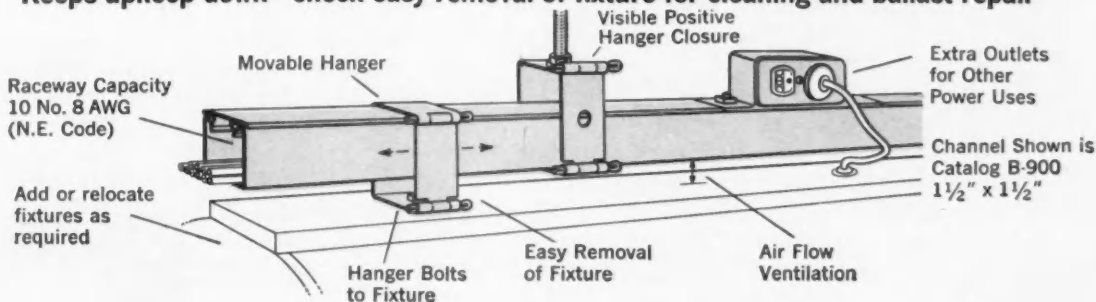
Channels of various depths and gauges, for use as surface raceway wiring systems or for fixture support only, are available as standard.

When used as a raceway, the Channel capacities are more than ample for every lighting requirement—up to ten No. 8 AWG conductors (National Electrical Code).

### MONEY SAVING FEATURES . . .

- Eliminates cutting and threading of conduit
- Reduces number of hangers
- Uses existing boxes for wiring feeds
- Plug-in method reduces wiring costs
- The greater hanger spacing allows use of existing boxes with fewer intermediate hangers
- Pre-wiring of long lengths of channel at bench level
- Top mounted receptacles provide outlets for portable tools and machinery.

**Keeps upkeep down—check easy removal of fixture for cleaning and ballast repair**

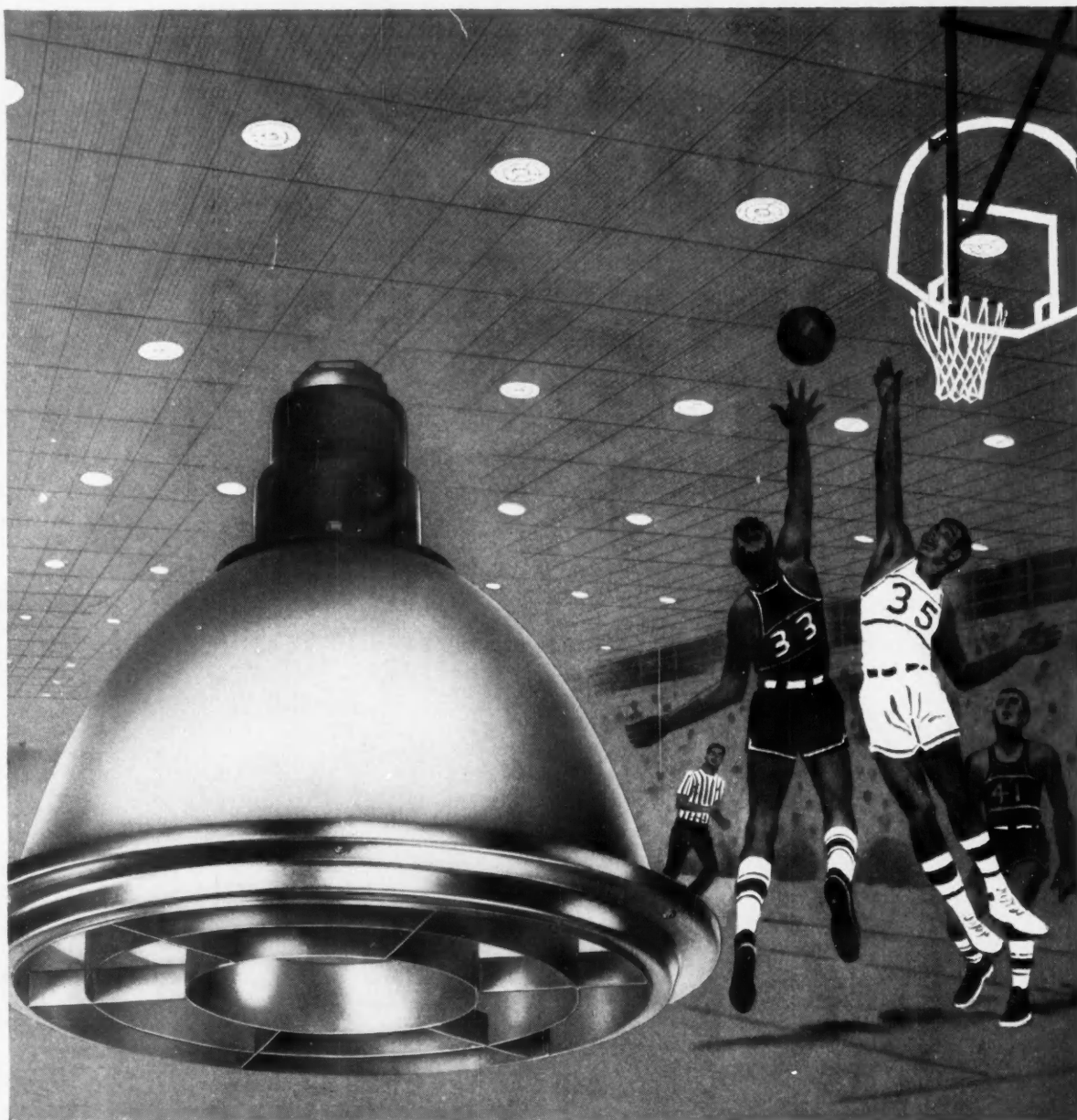


Write for Free Booklet G-2



**Steel City**  
PITTSBURGH 33, PA.

STEEL CITY ELECTRIC CO. — A CONSTRUCTION MATERIALS DIVISION OF **MARTIN MARIETTA**

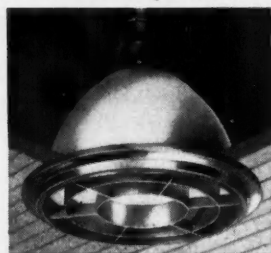


## RECESSED FIXTURES PUT SPORTS IN A NEW LIGHT

made of light, sturdy non-breakable Alzak aluminum. Protected by concentric louvers which provide deep 40° shielding, eliminate glare for players and spectators. Large center opening permits bulb replacement from the floor with a pole re-lamper. These easy-to-install recessed fixtures come complete with plaster rings, finish rings and screws. Available in 18" diameter for 400 watt mercury lamps, and 14", 16" and 18" sizes for 300-1500 watt incandescent lamps. To put sports in a new, modern light, get complete information on the Abolite line of gym fixtures. Our catalog is yours for the asking.

**ABOLITE**  
*Lighting*

THE JONES METAL PRODUCTS COMPANY  
West Lafayette, Ohio



# Control cable insulated with TEFLON<sup>®</sup> provides utmost accuracy

The outstanding insulating characteristics of TEFLON fluorocarbon resins are being put to good use in a variety of signal and control-cable constructions, particularly when accuracy and reliability must be maintained under difficult environmental conditions. A case in point: an electronic tank-level gauge (below) uses a low-level UHF probe to make its measurements. The long cable which transmits signals in both directions must maintain constant cable impedance, through wide variations in temperature, pressure, humidity and corrosive atmospheres and products. To achieve the required consistency and precision in measurement, Gilbert & Barker Mfg. Co., West Springfield, Mass., standardized on cable insulation of Du Pont TEFLON: primary insulation is tape of TFE resins; jackets

are made of FEP resins. The manufacturer's comment on the new construction: "This is the ultimate—we have had no known insulation of jacket failures."

The melt-processible FEP resins now make available the established reliability of TEFLON resins in the form of long, continuous extruded lengths of wire and cable insulation and jacketing. It will pay you to evaluate the family of TEFLON resins as insulation for signal and control cable, thermocouple wire, hookup wire, heater cables and the like.

• • •

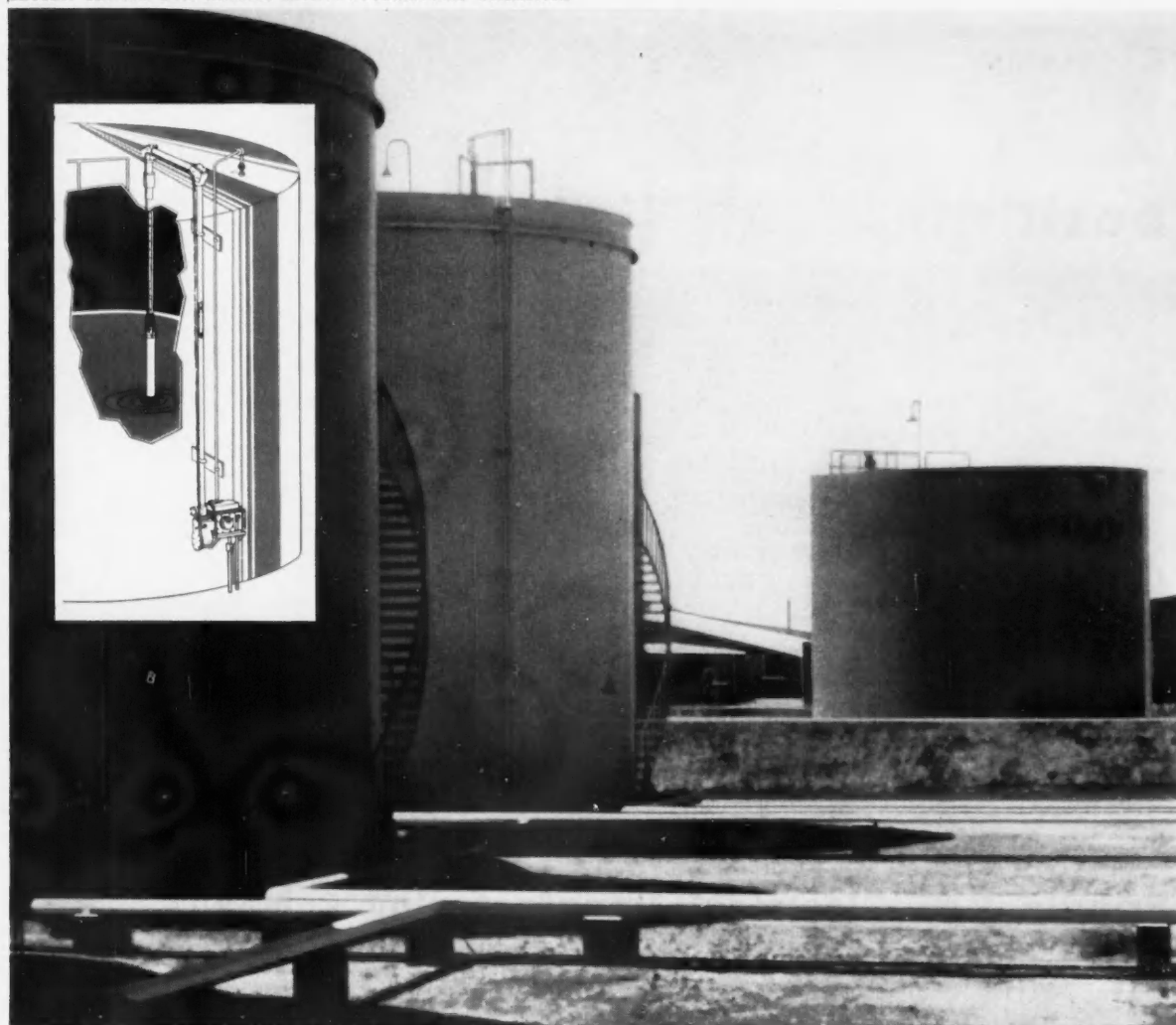
For more information, write: E. I. du Pont de Nemours & Co. (Inc.), Dept. EC-10, Room 2526T Nemours Building, Wilmington 98, Delaware. *In Canada:* Du Pont of Canada Limited, P.O. Box 660, Montreal, Quebec.



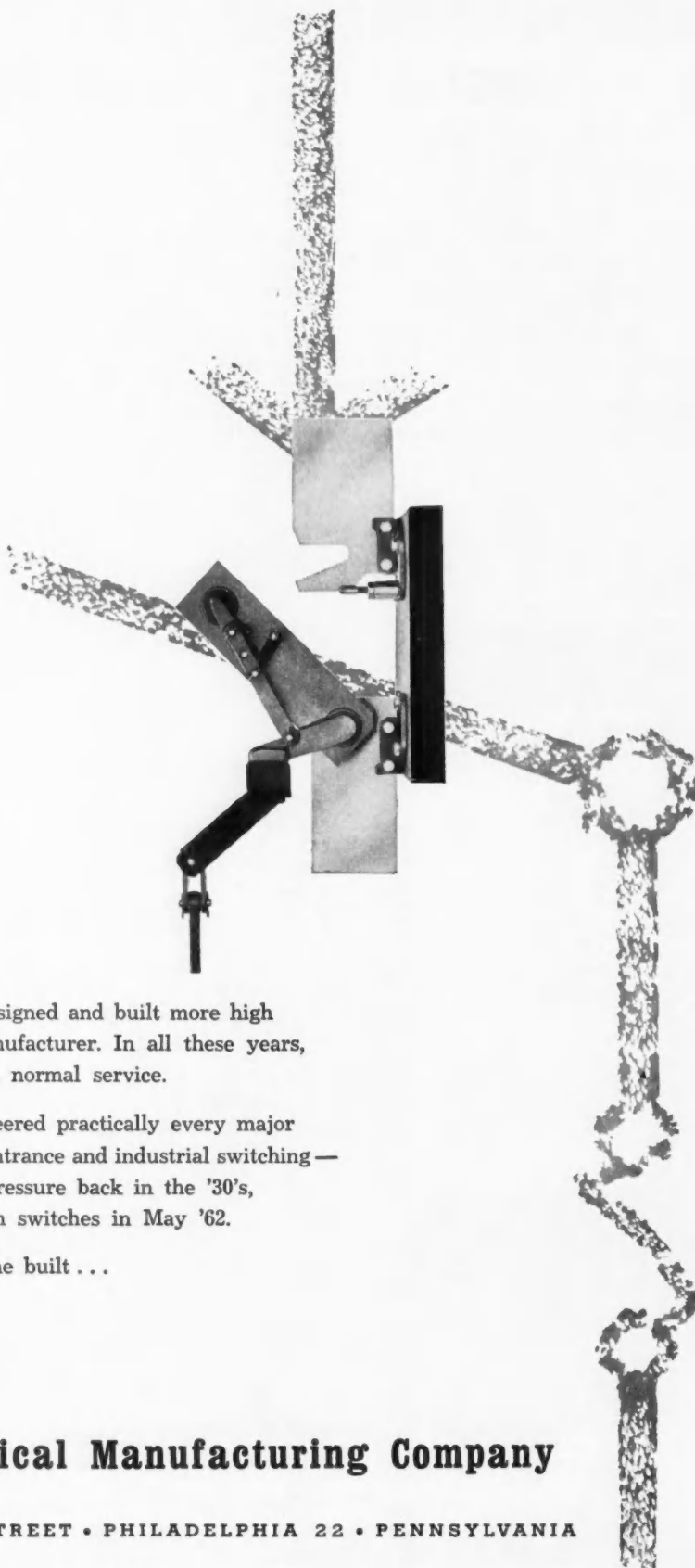
**TEFLON<sup>®</sup>**  
FLUOROCARBON RESINS

BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

*TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, fibers and film, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resins.*



**The  
switch  
that  
time  
built**



In these past 71 years Pringle has designed and built more high current switches than any other manufacturer. In all these years, a Pringle switch has *never* failed in normal service.

And along the way Pringle has pioneered practically every major development in high current service entrance and industrial switching — including the innovation of Bolted Pressure back in the '30's, and the introduction of all aluminum switches in May '62.

Specify Pringle — the switch that time built . . .  
and the switch time has proved.

**Pringle**

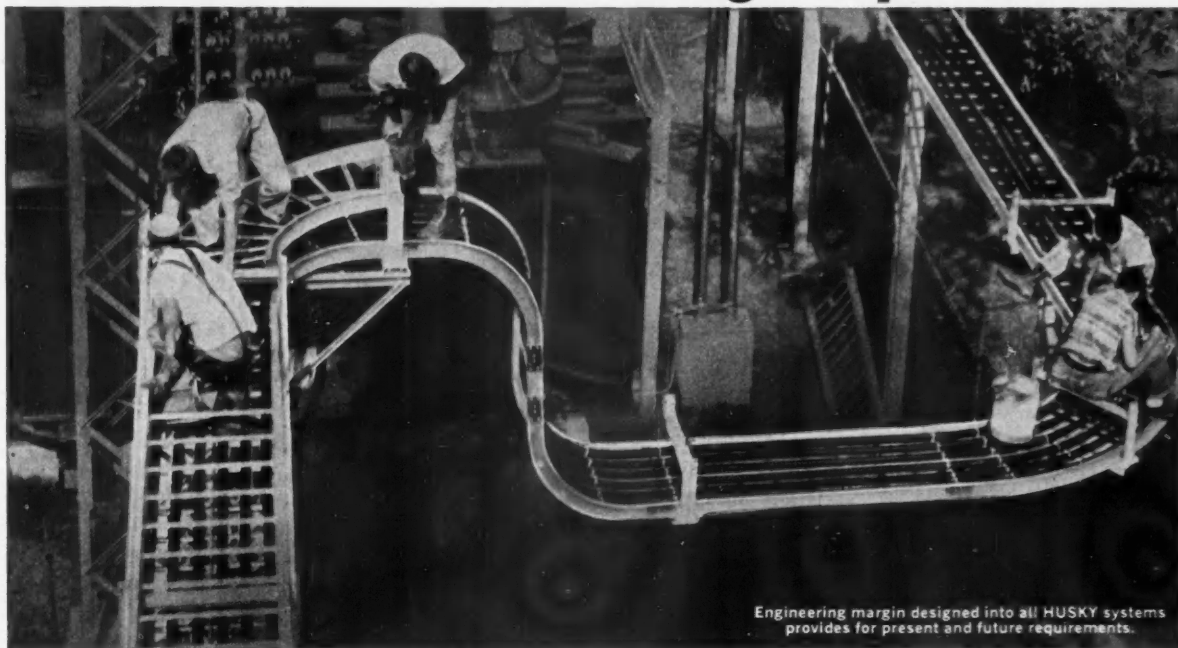


**Electrical Manufacturing Company**

1900 N. SIXTH STREET • PHILADELPHIA 22 • PENNSYLVANIA

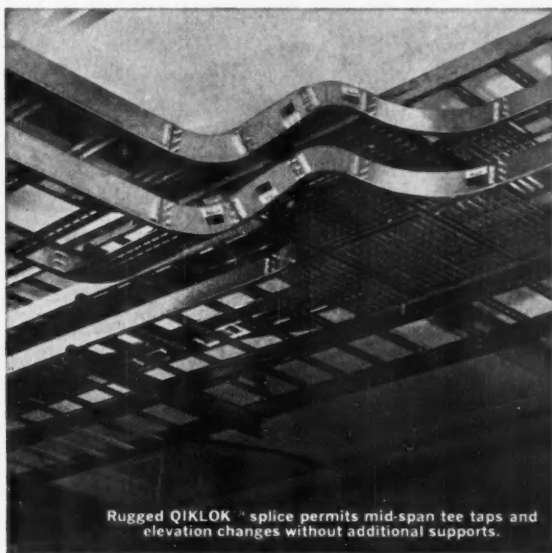


# **HUSKY** Cable Support Systems... Meet New NEC Grounding Requirement\*



Engineering margin designed into all HUSKY systems provides for present and future requirements.

## **A System For Every Application...**



Rugged QIKLOK® splice permits mid-span tee taps and elevation changes without additional supports.



Complete cable support systems (with structures) provides economical approach to modernization.

## **... A System For Every Budget!**

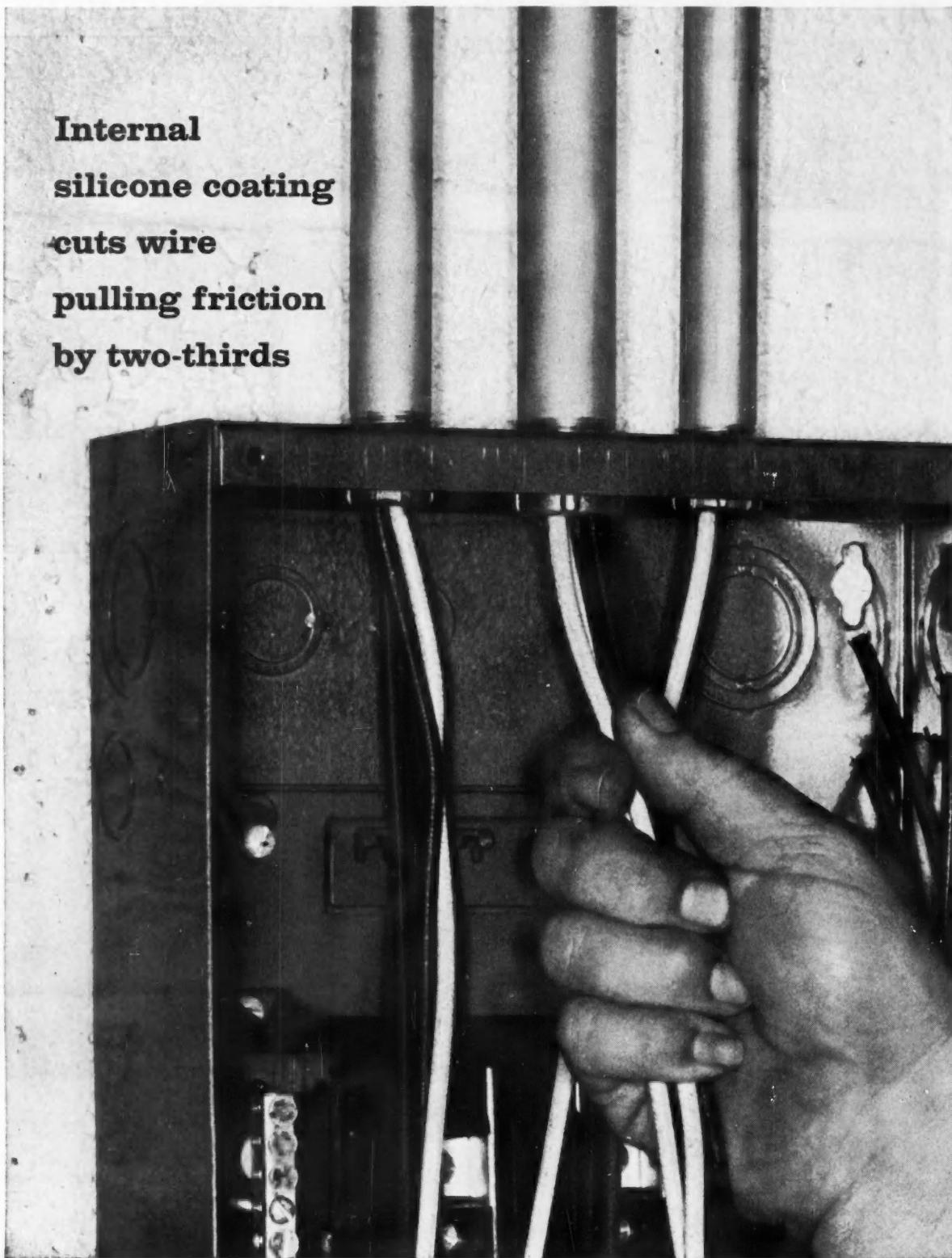
\*For copy of NEC Article 318 (National Electric Code) and comparative installation cost studies of HUSKY products write:

**HUSKY** PRODUCTS, INC., DIV. OF **BURNDY** CORP.

5300 VINE STREET, CINCINNATI 17, OHIO

# REYNOLDS ALUMINUM

**Internal  
silicone coating  
cuts wire  
pulling friction  
by two-thirds**



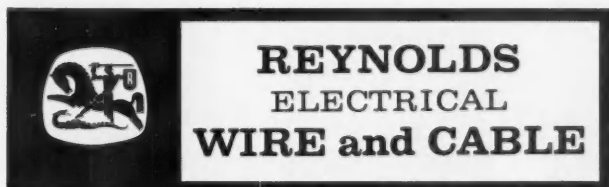
# RIGID CONDUIT

**Here's how Reynolds conduit  
can cut your installation  
and maintenance costs:**

**Smooth Silicone Coating** cuts labor and installation costs. In tests comparing coated and bare conduit, Reynolds coating reduced pulling forces by two-thirds. On the job, this means reduction in man hours and labor costs . . . an important factor to help lower your competitive bids. The silicone coating is odorless, nonflammable, and harmless to insulations and coverings. For example, because cables slip around 90° bends easier, you have fewer cable breaks and more flexibility in circuit design.

**Lightweight Aluminum Conduit**, weighing only one-third as much as steel, can be handled and installed easily. It bends and forms quickly and accurately. It is easy to thread, easy to cut. And it can't rust ever—resists corrosion due to weather and most industrial atmospheres. Even threads cut on the job can't rust. It is non-magnetic, reduces voltage drop, makes possible longer runs or smaller conductors.

For complete information and names of Reynolds Aluminum Rigid Conduit Distributors, call your Reynolds sales office or write *Reynolds Metals Company, P. O. Box 2346-ET, Richmond 18, Va.*



Watch Reynolds exciting TV program on NBC: The Dick Powell **Reynolds Aluminum Show** Tuesday nights.

**SPECIAL:** See the 1963 cars on the color telecast of The National Automobile Show direct from Detroit on Sunday, October 21, NBC-TV, 6:00 to 7:00 p.m., EDT.

## ● Put Reynolds Building Wire and Service Entrance Cable to work for you, too . . .

Reynolds now offers building wire and service entrance cable in a complete range of sizes and types to meet your specifications. Aluminum or copper conductors . . . rubber or plastic insulations. See your nearest Reynolds Distributor or write to address at left above.

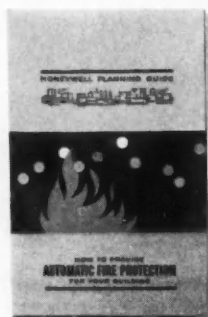
# Fastest fire detector...



## Free! Building System Planning Guides for

Four, new, authoritative guides designed to help you advise your clients on how to get the best electrical systems when they build or remodel. Guides cover new techniques and developments. They help your clients avoid early obsolescence and high maintenance costs. Point out the advantages of a quality installation. They give you new background information. And they're all from Honeywell—the only company that designs, builds, installs and guarantees all these building systems.

Mail the coupon now for your Planning Guides. Check them all if you wish.



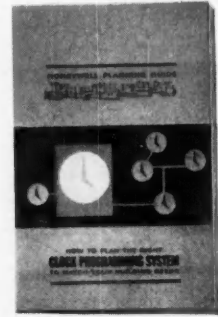
### AUTOMATIC FIRE PROTECTION

Explains principles, different automatic systems, best way to protect lives, property.



### SECURITY AND EQUIPMENT SURVEILLANCE SYSTEMS

Covers different ways to protect against intruders plus equipment monitoring.



### CLOCK PROGRAMMING SYSTEMS

Gives advantages of system for different types of buildings, new developments.



# Honeywell Smoke Sentry!

*Smoke Sentry matched against all major types of fire detectors by Los Angeles Fire Department. Sounded alarm first in 8 out of 10 fires.*

Acting under the supervision of the National Fire Protection Association, the Los Angeles Fire Department set a total of 102 fires in the condemned school shown at left.

Chief purpose of one series of tests was to measure the response time of automatic fire detectors. In 8 out of 10 of these tests, Honeywell's Smoke Sentry was the first to detect fire. And in one test, involving a near explosive-type atmosphere, the Smoke Sentry triggered the alarm just one second after the fire was started.

**Why such unusually fast response?** Honeywell's Smoke Sentry isn't actuated by what can be a relatively slow increase in room temperature. It detects smoke . . . the first sign of fire!

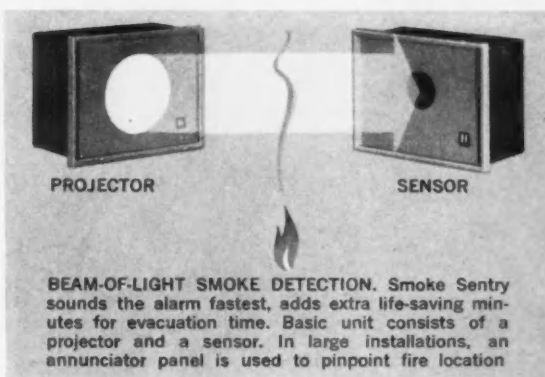
Despite its extreme sensitivity, a built-in time delay eliminates false alarms that could be caused by an object, such as the top of a ladder, passing through its watchful beam. And the Smoke Sentry can be set for different densities of smoke to protect different types of areas.

We suggest you investigate Honeywell's Smoke Sentry for your jobs. It gives your customers a vital extra margin of safety . . . yet it costs no more than many other types.

Your customers' price for one Smoke Sentry set adequate to protect one stairwell or an area up to 30 ft. wide by 150 ft. long is approximately \$200. Price includes

projector, sensor, power supervisory panel and a constant voltage transformer.

Your nearest Honeywell Office will be glad to furnish complete information at no obligation. Or, if you prefer, mail the coupon below for the Planning Guide on "Fire Detection and Alarm" plus any others you would like. Sales and service offices in all principal cities of the world.



\* UL Approved

## Honeywell

**your clients**



*First in Control*



### PREVENTIVE MAINTENANCE PROGRAMS

Tells ways maintenance can cut costs. How to make sure client's program is adequate.

CHECK GUIDES YOU WISH. MAIL COUPON

To: Minneapolis-Honeywell, Dept. EC10-66.  
2753 Fourth Ave. South, Minneapolis 8, Minn.

Please send me the following Planning Guides.

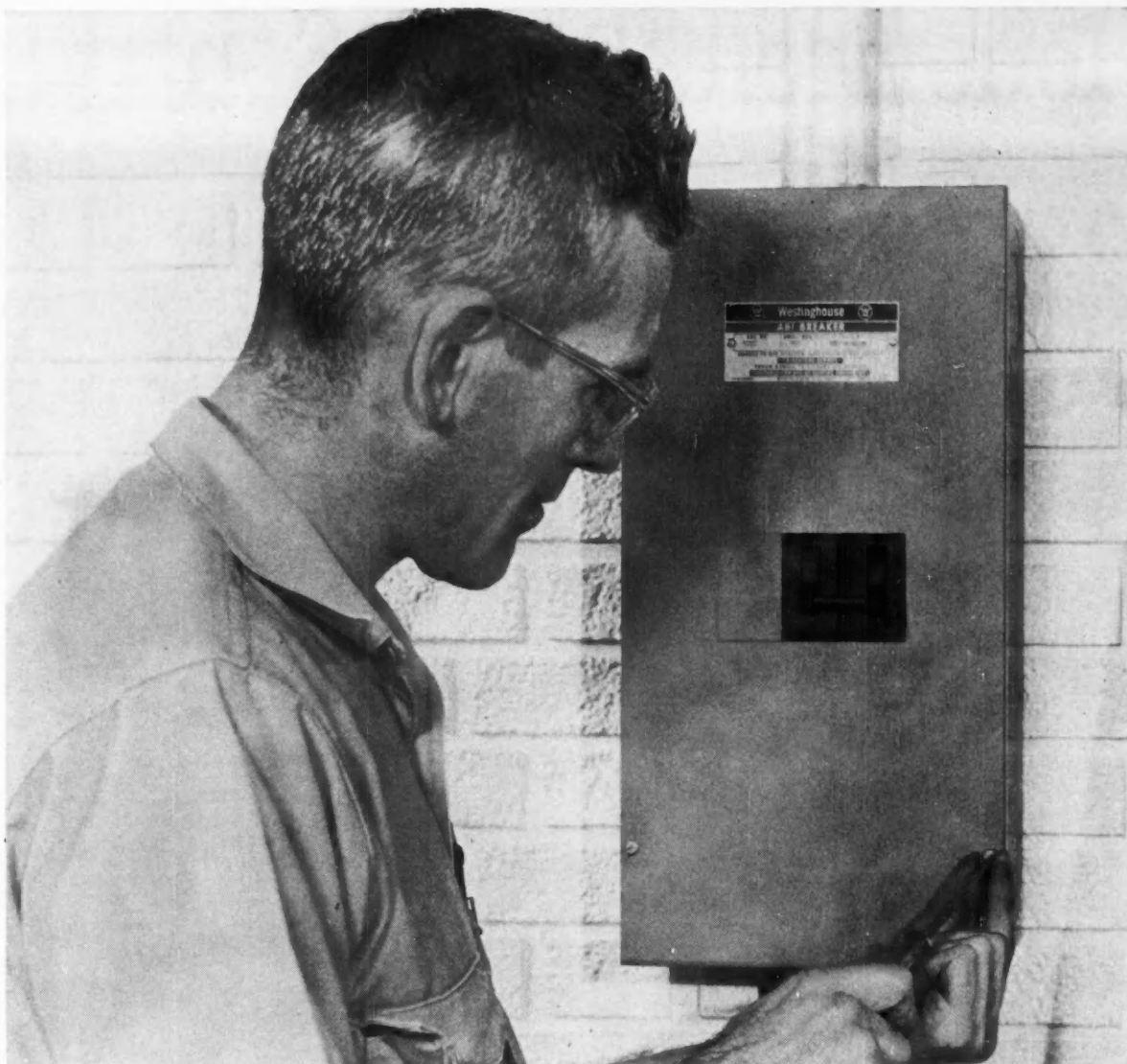
- ☐ Automatic Fire Protection ☐ Clock Programming Systems  
☐ Security and Surveillance ☐ Preventive Maintenance Programs

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



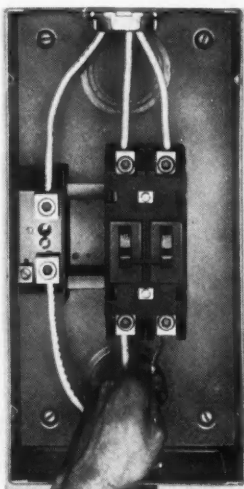
## A new 200-amp AB-I breaker for only \$84 list!

From Westinghouse comes a complete new line of 200-amp AB-I, type QCC circuit breakers. They are designed for service entrance use up to 240 volts a-c and have a 10,000 amp interrupting capacity rating.

Priced at only \$84.00 list, Westinghouse QCC AB-I Breakers include quality features such as: De-ion arc quenchers, a quick-make, quick-break over-center toggle mechanism and thermal magnetic trips.

AB-I Breakers have no fuses so there is no costly maintenance or downtime for fuse replacements. The operator resets the QCC AB-I easily and safely.

Westinghouse QCC AB-I Breakers in-



corporate all the standard AB-I features, and are available in 1-pole, 2-pole and 3-pole styles with individual or common trip. Choose the QCC AB-I Breakers in NEMA 1 Surface Mounted, NEMA 1B Flush Mounted or NEMA 3-R Rain-tite enclosures.

For complete information on QCC AB-I Breakers, contact your Westinghouse sales engineer or write: Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

*You can be sure . . . if it's Westinghouse.*

J-30333

# Westinghouse



# "Hard Hats" Prefer T&B Distributors . . .



because they're a local source for over 60,000 Code approved products. T&B products cut installation costs. T&B distributors reduce your operating costs.

Here is an example of a product line that can put dollars into your pocket. All of the products below are listed by Underwriters' Laboratories, Inc., and meet or surpass the requirements of T&B Laboratories and the National Electrical Code, paragraph 373-6 (b). The bright blue nylon liner is a T&B exclusive . . . insulates and protects wire **during** and **after** installation. A flawlessly smooth surface measurably reduces wire pulling effort. The insulated throat is unaffected by moisture, high operating temperatures and common corrosive atmospheres. The result is lowest installed cost and no callbacks.

## INSULATED THROAT FITTINGS FOR LIQUID TIGHT FLEXIBLE CONDUIT



1. Liquid Tight for Threaded Outlets
2. Chase® Liquid Tight for JIC Boxes

## INSULATED THROAT FITTINGS FOR STANDARD RIGID CONDUIT



1. Threadless Connectors
2. Chase® Nipples
3. Insulated Threadless Elbow

## BLUE BUSHINGS FOR RIGID CONDUIT



1. Unbreakable Plastic Bushing
2. Insulated Grounding Bushing
3. Insulated Metallic Bushing

## INSULATED THROAT FITTINGS FOR E.M.T. AND FLEXIBLE CONDUIT



1. E.M.T. Raintight Connector
2. E.M.T. Raintight Short Elbow
3. Straight Tite-Bite® for "Flex"

SOLD COAST-TO-COAST THROUGH AUTHORIZED T&B DISTRIBUTORS



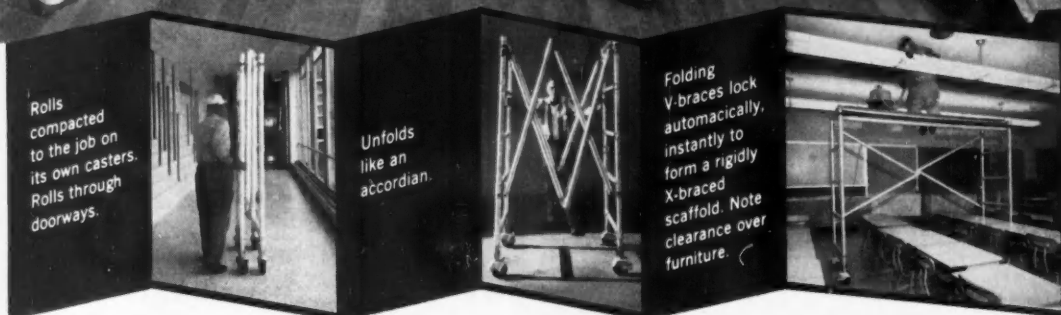
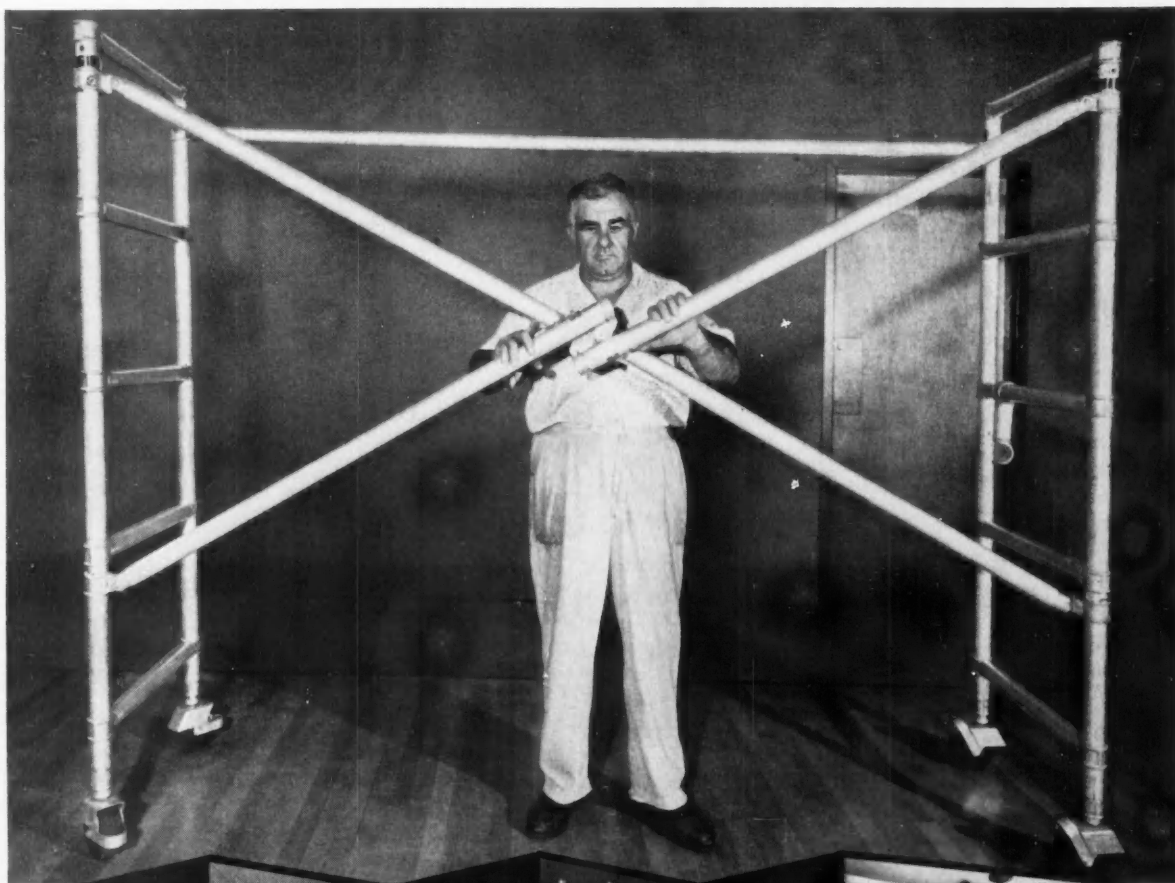
# THOMAS & BETTS

The Thomas & Betts Co., Incorporated • Elizabeth, New Jersey  
In Canada, Thomas & Betts Ltd. • Montreal



Insulated throat fittings are Patented.

# New one-piece scaffold unfolds and locks into shape in 10 seconds!



No tools required. No nuts, bolts, loose parts—nothing can be left out or lost! Platform height adjustable from 1 ft. to 8½ ft. Instantly adjustable legs. Lightweight aluminum: can be carried up stairs by 1 man. Compact: stores in same space as a step ladder. Interchangeable with all Up-Right span scaffolds in use.

## UP-RIGHT ALUMINUM **VX** SCAFFOLD

Write for circular: **UP-RIGHT SCAFFOLDS, Dept. 104, 1013 Pardee, Berkeley, Calif.**



# WIREMOLD® ELECTRIC IDEAS

PREPARED EACH MONTH FOR ELECTRICAL CONSTRUCTION AND MAINTENANCE  
TO BRING IDEAS, NEWS AND HELPFUL INFORMATION TO ELECTRICAL MEN

63rd YEAR

OCTOBER 1962

RACEWAYS FOR LIGHTING ..... FIRST PAGE

CODE COMMENTS ..... FIRST PAGE

NOTEWORTHY ..... THIRD PAGE

PRODUCT OF THE MONTH ..... THIRD PAGE

PRACTICAL TIPS ..... THIRD PAGE

ENGINEERED SPECIALS ..... FOURTH PAGE

QUIZ CORNER ..... FOURTH PAGE

COUPON FOR THREE ITEMS ..... FOURTH PAGE

## Raceways Are Effective Way to Wire for Lighting

Proper wiring important in installation of modern,  
efficient illumination systems

Ask the merchandising manager and the service manager of any store to name the most important elements required to satisfy a customer and one word is certain to appear on both lists — lighting.

By lighting, of course, they mean good lighting. And good lighting denotes proper wiring.

More and more, contractors and engineers are recommending surface systems in wiring-for-lighting jobs. This is true whether it be for general illumination, display lighting, or emergency lighting.

Among the reasons why surface

wiring systems have gained popularity with both installer and user are flexibility, ease of installation, accessibility and appearance.

For example, in wiring a new 84,000 sq. ft. maintenance hangar at Boston's Logan International Airport, engineers specified Wiremold 3000 to house the conductors for the combination incandescent and mercury vapor lamps. The system delivers 97 footcandles of balanced color-corrected illumination at working level.

Each of the two bays has 9 rows of lights with fixtures spaced about

*continued on second page*



INCANDESCENT and mercury vapor lights deliver 97 footcandles in new maintenance hangar. Use of surface wiring system made installation simpler, more economical.

Advertisement

### Code Comments

#### Outdoor Use of Raceways

**Q.** *Is it permissible to use Wiremold outdoors if it is protected from the weather?*

**A.** No. The National Electrical Code provides that ferrous raceways—fittings and boxes—protected from corrosion solely by enamel may be used only indoors and in occupancies not subject to severe corrosive influences. (Article 300-5)

#### Grounding Raceways

**Q.** *Should Wiremold raceways be grounded?*

**A.** Yes. Article 300, Section 300-9 (Grounding Metal Enclosures) states: "Metal raceways, boxes, cabinets, cable armor and fittings shall be grounded if and as prescribed in Article 250." This article, in Section 250-33 (Other Conductor Enclosures) specifies: "Metal enclosures for conductors shall be grounded, except they need not be grounded in runs of less than 25 feet which are free from probable contact with ground, grounded metal, metal lath or conductive thermal insulation and which, where within reach from grounded surfaces, are guarded against contact by persons."

#### Reason for Grounding

**Q.** *Why are metal raceways grounded?*

**A.** Article 250, Section 250-1 (b) (Exposed Conductor Enclosures) provides that: "Exposed conductive materials enclosing electric conductors are grounded for the purpose of preventing a potential above ground on the enclosures."

# WIREMOLD®

## Raceways Are Effective *continued from first page*

12 feet apart. The ceiling of each bay is a complex of steel trusses, the main members of which arch upward from the wall separating the two bays to a height of 50 feet at the entrance.

Key installation task was to bridge the gaps between each main truss with a rigid wire-carrying system that would be efficient, economical and flexible.

To simplify the installation, Wiremold engineers developed a special 3001B rigid outside coupling (see *Engineered Specials*, Oct. 1961) and a special 3046HX which features a built-in nipple to support the lighting fixture.

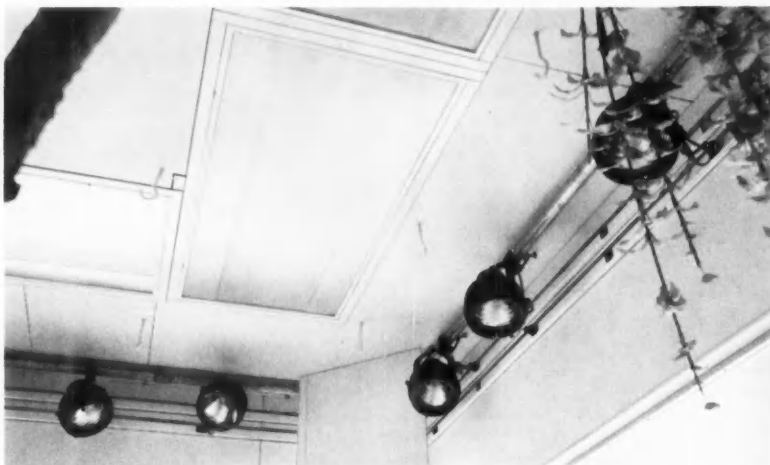
In other applications, surface systems are selected because they are versatile yet inconspicuous.

For effective lighting in the display windows of a modern specialty shop, twin runs of Plugmold® 2000 were run around three sides of the window. This enables the window dresser to move Kleig lights to any point where they are needed and be assured of an outlet into which they can be plugged.

In remodeling jobs — where new lighting plays an extremely important part — raceways perform a function virtually unattainable with any other form of wiring.

The elimination of the need for frequent breaking into old walls often is a major consideration. The ability to perform the installation without shutting down large areas of the structure also is of prime importance in such buildings as hotels and commercial establishments.

In homes, too, Wiremold lighting units play an important part. Slimline units are used to provide various types of dramatic illumination such as coffer, valance and cove lighting. The units, with their small cross section, provide maximum strip lighting in minimum space. They are ideal where it is desirable that ballasts be remotely located from the light source to eliminate noise and heat from the living area.



**SURFACE SYSTEMS** give added flexibility to display window lighting in this fashionable suburban shop. Kleig lights are plugged into twin runs of raceway.



**WIREMOLD 21SW** units supply fluorescent lighting to this remodeled electric accounting room. Luminous ceiling will screen slimline units.



**EXIT SIGN** is suspended directly from Wiremold 3000. Capacity of raceway permits running emergency circuit in channel.



**VALANCE LIGHTING**, using Wiremold slimline units, produces a dramatic effect in this modern home.

# WIREMOLD®

## Product of the Month

New 3046KT developed for three-pole breaker

Designed to permit mounting a 3-pole, common trip circuit breaker in a continuous run of Wiremold 3000, the 3046KT circuit breaker housing allows room for additional wiring in the raceway.

Originally developed as an engineered special (ED-40124, Electric Ideas, March 1962), field response was so great that it was decided to put this fitting into the standard Wiremold line.

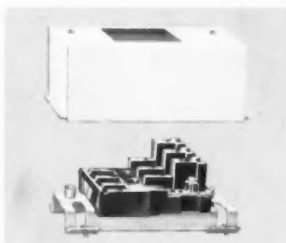
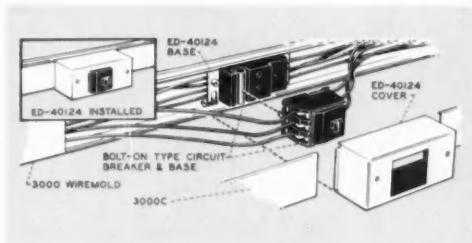
The 6-in. long fitting extends 2 3/4-in. above the raceway. This added height permits the use of a continuous run of raceway by providing space for conductors to pass beneath the breaker. By this

method, the listed wire capacity of the raceways with devices is maintained.

The 3046KT does not replace the standard 3046KD. The latter fitting is intended for use with single-pole and 2-pole cbs. Either housing may be obtained from distributors as a catalog item.

Like the raceway itself, the fitting is made of .040-in. steel and is available in either the standard Wiremold finish or in ASA-61 (20% reflectance) gray.

The new fitting dramatically demonstrates the oft-made point that Wiremold products are designed to meet in-field problems.



## Practical Tips

### Snake leader simplifies fishing through raceway

The Wiremold Company has designed a special 616 Snake Leader to simplify drawing conductors through three series of one-piece raceways — Wiremold 500, 700 and 1000.

The slim 6-in. leader allows conductors to lie parallel to each other without cross-overs and kinks.

To use the 616, stagger-strip the ends of the conductors and attach each conductor to one of the eight holes at one end of the leader.

The snake is fished through the far end of the raceway and attached to the leader through the hole provided.

The leader and conductors are finally pulled through the raceway in the same fashion as with conduit. Only one man is needed to perform this operation.

Wiring is done after the entire raceway system has been installed, in accordance with the recommen-

dations of the NEC.

For greater wiring ease, it is recommended that the 616 Snake Leader be used in combination with the 615 Wire Pulley.



## Noteworthy

### Out of stock

Sometimes even the most alert wholesaler may run out of a fitting just when you want it. Frequently, there's no need to hold up a job while you locate the part or undertake in-field improvisations.

In many cases, the flexibility of the Wiremold line permits interchanging parts.

Take, for example, the 1-gang boxes designated 5748S (15/16-in. deep), 5747 (1-3/8 D), 5745 (1-3/4 D), 5748 (1-3/4 D), 5744S (2-1/4 D), and 5744 (2-3/4 D). These boxes all have a common length of 4-5/8 in. and a width of 2-7/8 in. Also, all use the same base.

If it should happen that your supplier should be out of the box you want, substitute the next deeper size.

Or, suppose you want an open base with these boxes. Use one from the 5751 (all gangs) or 5760.

But, be sure to let your supplier know you expect him to reorder soon.

### Personnel at Meetings

NECA Annual National Electrical Exposition, Minneapolis Auditorium, Minneapolis, Oct. 10-12, Booth #142; Bill Parks, sales manager — electrical division, Edith Wootton, advertising manager, and Harlan Schendel, Minneapolis.

IAEI, Southern Section, Dinkler-Tutwiler Hotel, Birmingham, Ala., Oct. 14-17; Frank D'Esopo, home office, and Roy Pace and Howard Hanson, Biglin Associates.



Bill  
Parks



Edith  
Wootton



Harlan  
Schendel



Frank  
D'Esopo



Roy  
Pace



Howard  
Hanson

# WIREMOLD®

# Engineered Specials

## Special Plugmold unit with multi-pronged receptacles for control wiring

### PROBLEM:

To provide a method of having control wiring placed on a machine so as to become an integral part of the unit.

### SOLUTION:

A run of Plugmold 2100 was made up containing multi-pronged re-

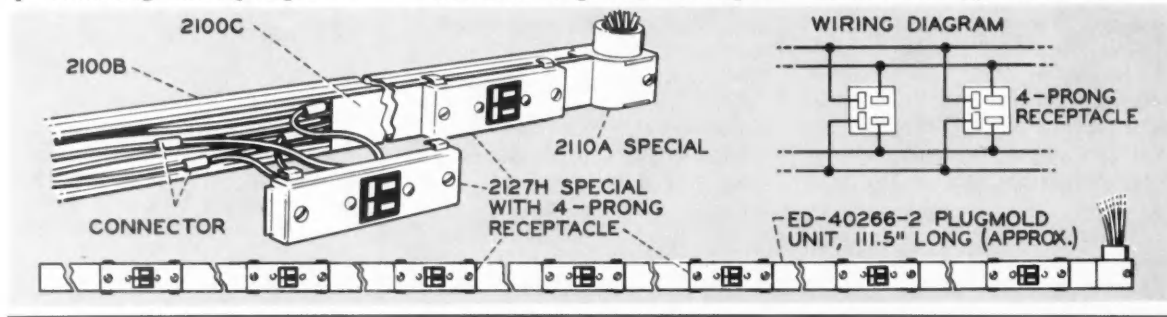
ceptacles and a special 2110A entrance fitting.

### DISCUSSION:

The designers of a large textile machine wanted to make the unit self-contained with its own control wiring.

Wiremold engineers developed

the ED40266-2 to meet this application. The 111-in. Plugmold 2100 unit contains 7 ED2442 (Special 2127H) multi-pronged receptacles on 16½-in. centers. The strip was then mounted on a structural member of the machine, becoming an integral part of it. A Special 2110A also was developed to permit connection with ¾-in. conduit.



## Quiz Corner

Questions for this department are taken from inquiries received from the field. Your questions are welcome; indeed, they are necessary if this department is to serve you with worthwhile information. Address:

Quiz Corner  
The Wiremold Company  
Hartford 10, Conn.

**Q.** Will Wiremold 3000 accept a 3-pole circuit breaker?

**A.** Yes, a 3-pole circuit breaker of the Square D type can be installed in Wiremold 3000 by means of a 3046KT. (See Product of the Month, third page.)

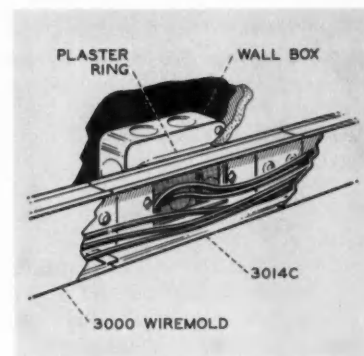
**Q.** What devices can be accommodated in the 1546A and 1546B boxes?

**A.** Any device designed for use in a single-gang box.

**Q.** Is Plugmold 2200 available in wired sections similar to 20G606?

**A.** Yes, on special order.

**Q.** What fitting do I use to extend Wiremold 3000 from an existing outlet box?



**A.** No. 3014C Wall Box Connector.

WIREMOLD ■ HARTFORD 10, CONN. E2-10

Gentlemen: Please send free the checked items

NAME \_\_\_\_\_ ☐ Electric Ideas, September 1962

COMPANY \_\_\_\_\_ ☐ Electric Ideas, August 1962

ADDRESS \_\_\_\_\_ ☐ Wiring Guide (Catalog 22)

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We've perfected a new, weaker tool. Pow-R-Set,\* for light- and medium-duty fastenings.

Too weak to over-penetrate.

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But strong enough to anchor an

aluminum window track.

Or set a metal channel runner.

Or fasten any light gauge metal or wood to concrete (up to 6,000 p.s.i.) or steel (up to  $\frac{3}{8}$ " thick). Quickly and permanently.

Pow-R-Set works on a totally new principle.

Instead of shooting, it ham-

mers. The powder charge drives a piston inside Pow-R-Set's barrel. The piston drives the fastener home.

In one mighty (weak) surge.

For complete information, the man to see is your local Ramset® dealer. He's listed in the Yellow Pages, under "Tools."

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285-J Winchester Avenue, New Haven 4, Conn.



*With Fiberglas Polarized Lighting Panels, truer color definition is achieved at The Rambler Center, San Antonio, Texas. The soft textured*

## "FINISHES AND FABRICS SHOW THEIR COLORS



Customers in this auto showroom see the colors of the cars true and clear. The light is bright, but with no harsh shadows or glare. It comes through Fiberglas\* Polarizing Light Panels, the most advanced improvement in interior illumination.

A. J. Anders, General Manager of The Rambler Center, says: "With ordinary lighting, a customer might see one color in a showroom, but another color in regular daylight . . . We were adamant about solving this problem . . . The answer involved the uses of recessed fixtures with Fiberglas Polarizing Panels . . . The results have certainly been worth the investment."



*appearance blends in with the ceiling.*

## ...WITH POLARIZED LIGHTING"

Recently, at Ohio State University, the benefits of polarized light were tested and verified: polarized light substantially reduces reflected glare. It also significantly improves color definition, visual performance, and task visibility compared with nonpolarized light.

Insist on *Fiberglas* Polarizing Light Panels in Day-Brite or any lighting enclosures you specify. For full information or visual demonstration, write: Owens-Corning Fiberglas Corporation, Industrial and Commercial Division, Dept. E-1, 717 Fifth Avenue, New York 22, New York.

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\*T.M. (Reg. U.S. Pat. Off.) O.C.F. Corp.



"Extremely accurate,"  
Denver sales manager



"Beautiful styling,"  
Seattle accountant

## 3 out of 4 people prefer

Put this over-all preference to work for you with Honeywell electric heat

In a recent survey of homeowners, three out of four, familiar with controls, preferred Honeywell.

Most of your new customers have lived with Honeywell controls. Shouldn't you put this overwhelming preference to work for you in your installations?

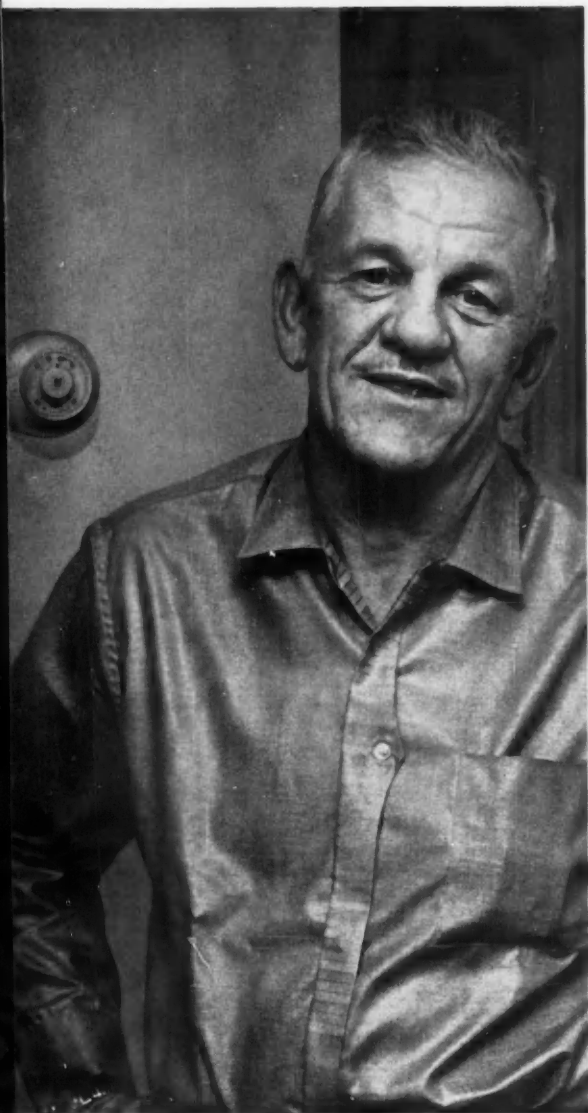
When you combine Honeywell with your own fine brands of electric heating equipment, you've got a combination that can mean more customer satisfaction, easier sales, more profits. Let Honeywell's new electric heat thermostats and new linear limit control join your sales team. They can be a big help.

### Low-Voltage Controls let you offer variety

With the Honeywell R8097 Relay, which allows you to use Honeywell's low-voltage controls, you can offer the widest range of low-voltage thermostat combinations in the industry. All the way from the most economical to the famous Honeywell Round to the deluxe thermostats and Control Centers.

Why don't you ask for detailed information on both low-voltage and line-voltage temperature controls now? Just call the nearest Honeywell sales office or write Honeywell, Dept. EC10-24, Minneapolis 8, Minn.





"Mighty reliable,"  
Detroit truck driver



"I'll make my own controls,"  
Free-lance scientist

# Honeywell Controls

controls, too. They'll help you sell the high quality of your installation.

The new wall-mounted Honeywell T462 Line Voltage Electric Heat Thermostat (and unit mounted T460) give dependable, worry-free performance. The control range is from 40° to 85° with a one-half degree differential.

New, rugged construction makes the units stronger. They are easier to set, rugged and dependable, too. They operate electric heaters up to 5000 watts, responding to both radiant and convected heat. Two switching variations are available in both models. Model T462A and T460C are SPST that make on a temperature fall and provide a line break at NO HEAT. Models T462B and T460D have the added feature of breaking both lines in OFF position.



**NEW, EXCLUSIVE ELECTRIC HEAT TRAINING PROGRAM!** Sales and service meetings studying a new and thorough working manual: "Fundamentals of Automatic Electric Heating." Call the Honeywell office nearest you about the next session.

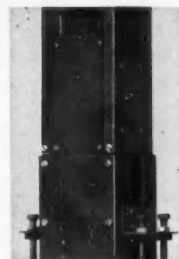
## Honeywell



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**I-T-E CIRCUIT BREAKER COMPANY**  
BULLDOG ELECTRIC PRODUCTS DIVISION

BOX 177 • DETROIT 32, MICHIGAN

In Canada: 80 Clayson Rd., Toronto, Weston, Ont.

## ***Motel Pool Safety Procedures***

A vacation motor trip through eight states this summer landed us in a succession of motels and motor lodges with accommodations varying from the merely luxurious to the fabulous. A universal delight is one or more fully equipped and lighted swimming pools. Parents who have travelled long distances with children can truly appreciate the magnitude of such blessings.

To motel managers, however, the blessings of the swimming pool are mixed. The constant cleaning and upkeep are major chores. The inherent and inescapable risks, including the possibility of electrical failure, are a constant worry. But the pool is recognized as a vital and often decisive attraction for the well-heeled family trade. It is here to stay.

The hazards of 120-volt, wet-niche, pool lighting have been discussed here before. The practical solution—inherently safe, low-voltage installations—is readily available but progress is slow. It takes time for the word to get around and for contractors to become familiar with the unusual circuit requirements. In the meanwhile, hundreds of motel pools are being lighted with 120-volt equipment. Their operators need guidance.

It is usually conceded that regular inspection and maintenance will assure reasonable safety from shock hazard. After looking over a number of installations, we are not so sure. Superficial inspection can give no clue to the integrity of the electrical system. Opening seals and digging out connections for periodic inspection are obviously undesirable procedures. Instrument tests are excellent but to be effective they ought to be made frequently.

To give lighted-pool owners and users some peace of mind, we recommend a routine daily voltmeter probe of lights and pool hardware. And, secondly, a routine daily insulation test. The latter test can be easily provided for by installing double pole switches and bringing the circuit neutrals out to test jacks. Among the merits of this procedure are that it can be safely performed by pool maintenance personnel with a moderate amount of instruction and it involves no tampering with the electrical system. The contractor can be called in on any abnormal reading.

More sophisticated alarm systems permanently installed and providing continuous monitoring for stray electrical fields in the pool might be devised. But such systems would probably be fairly costly. Conversion to low-voltage operation, which eliminates the risk, is much to be preferred.

*Wm. T. Stuart*



**ARC CONTROL...SIMPLE AS SNUFFING A CANDLE. IN BULLDOG SAFETY SWITCHES, AN EXCLUSIVE VACU-BREAK® ARC CHAMBER EXTINGUISHES ELECTRICAL ARCS JUST AS EFFECTIVELY. BUY WITH CONFIDENCE...BUY BULLDOG. CONTACT YOUR I-T-E DISTRIBUTOR OR LOCAL I-T-E SALES OFFICE TODAY!**



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# **NEW DIMENSIONS IN LIGHTING APPLICATION**

Development and use of  
modern lighting tools and new  
application techniques are  
creating higher lighting standards,  
and advancing lighting know-how.

Promotion and use of these  
new devices and technology,  
such as used in typical installations  
described herein, can  
add new growth and vitality  
to the existing lighting  
market potential.

**By Berlon C. Cooper**

**L**IGHTING technology continues its expansion unabated. This advance in lighting "know-how," and in the design and development of new and improved lighting tools, is being reflected in thousands of current lighting applications in all types of structures throughout the country. These new and skillfully designed lighting installations are, in turn, setting new and higher lighting standards, and helping to create truly new dimensions in lighting.

Presented here is a roundup of typical lighting installations, recently made, each of which has been selected to illustrate one or more lighting application techniques that are representative of current advances or practices in lighting technology. Needless to say, space will not permit the inclusion of all new types of lighting devices, new light sources, new lighting techniques, and new application ideas. However, an effort has been made to include new ideas and new devices, equipments, etc., which appear to have broad application and a possible impact on future trends in lighting.

As is well known in the electrical industry, each outstanding new lighting installation serves as another display of good lighting practice. Thus good lighting jobs create new lighting prospects, and usually these are prospects for even better lighting—higher lighting levels, better lighting efficiency, and improved appearance. Good lighting is therefore really self-perpetuating, if the electrical men responsible for lighting designs, specifications, sales and installation will only take advantage of this inherent market growth feature.

Lighting sales over the past two or three years have failed to move ahead with vigor, as had been expected, following the approval and adoption of new and higher illumination levels by the Illuminating Engineering Society late in 1958. However, there have been no industry-wide promotion programs in effect, and the few promotional activities by individual segments of the lighting industry, or by individual organizations, have not been widespread or very successful. Certainly the potential market for lighting exists, however, and the lighting industry today has more and better equipment, and more advanced application knowledge, than ever before in its entire history. The fact that many outstanding lighting installations continue to be sold indicates that lighting prospects can be sold good lighting when the facts are properly presented. More and better lighting can help in the advancement of industry and commerce, and the standard of living. Now is an opportune time for the lighting industry, and electrical men responsible for lighting design, to take a fresh look at lighting, and at the potential for new efficiencies and higher economies afforded by modern lighting systems, and to upgrade every lighting job sold.

# INDUSTRIAL LIGHTING

**A** MERICAN industry considers good lighting in production areas as vitally necessary, and as an aid to lower production costs. In general, the IES recommended levels of illumination approved in 1958 are being installed in the new plants, or in factories which are being modernized; however, there are thousands of older plants which continue to operate with lighting which is wholly inadequate, and therefore costly. Recommended lighting levels for production areas range from 30 footcandles for rough work that is easy to see, to 200 footcandles for fine assembly work. The lighting level for typical production areas is usually 100 footcandles, and the recommended levels for many inspection areas range up to 500 and 1000 footcandles, on the point of work. Many plants are today lighted to a uniform level of 200 footcandles throughout, which permits full flexibility of machine and assembly line layout without regard to the lighting system layout.

Higher lighting levels are no longer a full measure of the quality of an industrial lighting installation. Other considerations include the provision of some upward components of illumination to light the ceiling, and reduce the contrast (glare) between a lighted luminaire and its background area when viewed from below. The amount of light directed upward usually ranges from 10 to 40%, depending upon the reflection factor of the ceiling, and the degree of light diffusion desired. Also, in some types of installations, vertical illumination may be important. In others, direct shielding of the luminaires

in the 0° to 45° zone (direct glare zone) may be desirable. Or, color quality of the light produced may be a factor to be considered. But whatever the problem, both the technical solution and the type of equipment required are now usually available.

In general practice, it is normal procedure to use fluorescent reflector luminaires for general illumination in low bay areas, and mercury vapor reflector units for high bay areas. Either fluorescent or mercury vapor units may be used for medium bay lighting, depending upon the economics of each type for the specific problems involved. Incandescent units are less popular for industrial lighting, but the possibility of using quartz-iodine lamps at 240 volts or 277 volts makes their use practical under certain conditions. The fact that fluorescent lamps are available for 430, 800 and 1500 ma operation adds to their popularity in achieving different levels of illumination for different lighting problems in adjoining areas.

Lighting levels of 300 to 1000 footcandles and above, required usually for very fine assembly work, inspection problems, etc., are normally achieved with special equipment, installed separately and supplementary to the over-all general lighting system. When mercury vapor light sources are used, it is good practice to also use either incandescent or fluorescent units in the system, to provide some lighting in case of sudden power failure which would put the mercury units out of use for a period of from five to seven minutes—time normally required for mercury lamps to cool off and restart.

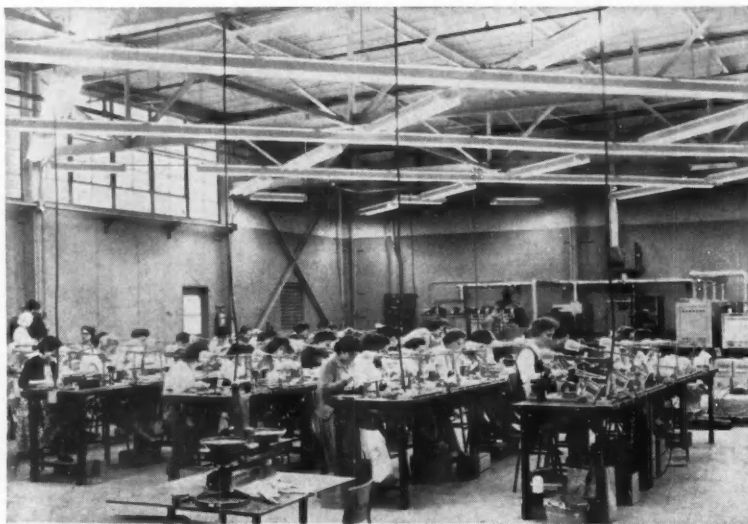
Production and employee morale are both high at Scot Inc., electronic plant, Downers Grove, Ill., due in very large part to the excellent lighting and comfortable visual en-

vironment. General illumination averages 200 footcandles maintained throughout the area, while a lighting level of 750 footcandles is provided on the seeing tasks.

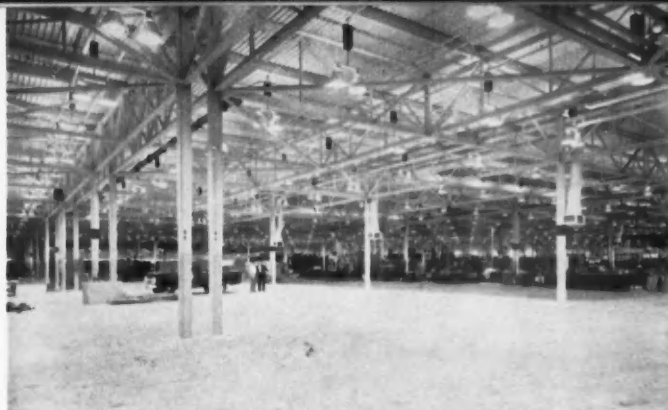
Under these ideal lighting conditions, seeing is less fatiguing, and productivity and general efficiency are both high.

The uniform general illumination is provided by Guth 25% upright industrial reflectors, equipped with two 1500-ma rapid start fluorescent lamps for each 8-ft reflector unit, arranged in a grid pattern, and with continuous rows running at an angle of 45 degrees to the side walls. The ceiling is painted flat white, and the floor and side walls are finished in a light color. The upward component of light from the reflectors lights the ceiling uniformly and softly, and helps to improve the visual environment and general appearance of the area.

At the critical work area points small direction lights supplement the general illumination and provide 750 footcandles, for the super-fine work with size 45 magnet wire which is involved. The high mounting height of the overhead fluorescent reflector units, plus the grid pattern layout, minimizes shadows, and provides good cross-shielding from normal sight angles.



**GENERAL ILLUMINATION** of 200 footcandles, provided by 1500-ma fluorescent lamps in reflectors installed in grid pattern, is supplemented by light from local adjustable reflector units to provide 750 fc on the superfine work in this plant.

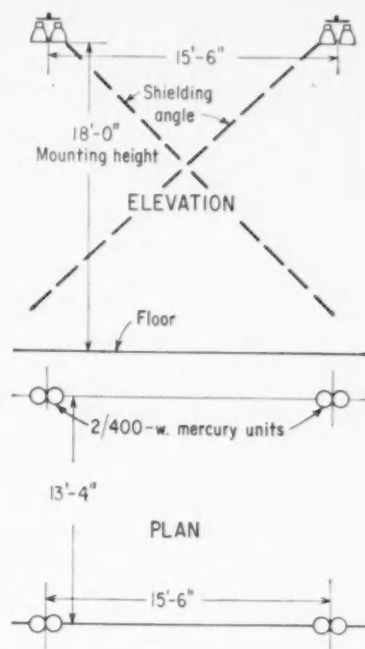


**DUAL-UNIT** prismatic glass reflectors equipped with 400-watt mercury vapor lamps provide 100 fc maintained in this production area.

Production areas in the engine plant of Allis-Chalmers Manufacturing Co., Harvey, Ill., are lighted to an illumination level of 100 foot-candles maintained. This lighting is provided by two-reflector mercury vapor units, spaced on 13-ft 4-in. by 15-ft 6-in. centers, and installed 18 ft from the floor. Each reflector is a Holophane prismatic glass unit, provided with an aluminum cover, and equipped with a standard 400-watt color-improved mercury vapor lamp. Each two-reflector unit is further controlled

by a two-lamp transformer, mounted in the conduit stem suspension, as shown in the photograph above.

These reflector units are of the low bay type, with a 45-degree shielding angle of cutoff. This type of reflector provides a fairly high level of illumination in the vertical plane, as can be seen by the amount of light on the columns, near the base of each column. Horizontal illumination is uniform throughout the area, and uniformity is controlled by the spacings and mounting height. Up-



ward components of light from the reflectors are used to light the ceiling, which keeps glaring brightness contrast low and creates a bright and cheerful work environment.

The rotogravure press room at Mead Packaging Division, Mead Corp., Atlanta, Ga., has been lighted most satisfactorily and effectively by explosion-proof fluorescent luminaires. The lighting problem presented here was typical of that found in many areas of industry, and its solution is therefore most timely.

The Mead Packaging Division is one of the largest manufacturers of soft drink cartons, and a leading producer of the multiple-unit type of package. These containers are constructed of paper board, which is fed through presses at the rate of 1200 ft per minute, and the firm requires that printing and colors on the cartons must be of the highest quality. Thus the lighting of their 40-ft by 100-ft press room had to meet two important requirements. First, the lighting units were required to eliminate any explosion hazard, and second, they had to provide high levels of illumination necessary for quick checks on printing and colors on the fast-moving kraft board.

In selecting lighting units which would meet these rigid requirements, Appleton explosion-proof

fluorescent luminaires were chosen. A total of 34 2-lamp units, with 200-watt capacity each, is used. The luminaires are suspended in two rows at a height of 15 ft from the floor, and are spaced on 8-ft centers. The units are bolted directly to the ceiling structural work. Switching is by remote control.

Emphasis was placed on lighting of the area around Scan-A-Web checking equipment, where quick examinations are made for color laydown in work which runs as high as nine colors, and checks are made for printing register and feed-up. This checking is done while the press is running at a rate of 1200 ft per minute. Lighting levels range up to 150 footcandles, and lighting flexibility is made possible since individual luminaires may be moved easily by simply connecting the luminaires to a new conduit location. Since this new lighting was installed, no work stoppages have occurred, as had previously been the case.

The explosion-proof feature is made necessary, since thinners which emit combustible vapors are used in blending inks with alcohol and lacquer. Use of the explosion-

proof units gives the firm a good fire underwriters rating, as any electric spark which might occur in the luminaire is harmlessly snuffed out within the luminaire.

Maintenance is made simple, since all that is required is the simple wiping of the tubes which envelop the lamps with a damp cloth.

These luminaires are highly efficient in producing light, as 1500-ma lamps in 4-ft lengths are used.

**EXPLOSION-PROOF** fluorescent luminaires, each equipped with two 1500-ma 4-ft lamps, provide up to 150 footcandles without hazard in this rotogravure room.





The initial lighting level in the Elgin Watch Co. plant at Canoga Park, Calif., was 265 footcandles. This high level lighting, required for the many critical seeing tasks involved, is provided by Smoot-Holman white porcelain enameled fluorescent industrial reflector luminaires, equipped with two 1500-ma type PG17 fluorescent lamps for each 8-ft reflector unit.

These high quality industrial reflectors have 30° crosswise shielding, and a 15% upward component of light which is provided through top openings in the reflectors. The crosswise shielding reduces glare in the direct glare zone, and the upward component of light illuminates the ceiling softly and uniformly, to provide a more comfortable visual environment. The ceiling illumina-



**1500-MA FLUORESCENT LAMPS** are used in white porcelain enameled open-top industrial reflectors to provide 265 footcandles in this watch factory.

tion is also aided in part by reflected light from the light colored floor and walls.

This high level of uniformly distributed illumination is obtained by mounting the individual 8-ft lu-

minaires in continuous rows, which are spaced 10 ft apart, and installed 10 ft above the floor. Total ceiling height is 14 ft, and the ceiling is also finished in a light color having a high reflectance.



**SEMI-DIRECT** low-brightness aluminum reflector units equipped with 1500-ma fluorescent lamps provide 200 footcandles of uniform general lighting in this coil winding plant.

A lighting level of 200 footcandles of general illumination maintained in service has been provided for workers at DeLuxe Coils, Inc., Wabash, Ind. Typical of current lighting practice in production areas where fine assembly work is done, this illumination level is obtained with a high degree of visual comfort. Two-lamp industrial reflectors, each 8-ft long, are installed in continuous rows, spaced 8 ft on centers, and mounted 8 ft 6 in. above the floor. Ceiling height is 10 ft. The lamps used are 1500 ma type PG17.

The Miller reflectors are made of Alzak aluminum, are slotted at the top to provide 25% uplight, and provide 35-degree crosswise shielding of the lamps. The reflector finish is of the low-brightness type, which further adds to the visual

comfort. With the uplight component of light directed to the white ceiling, the reflector brightness is approximately the same as that of the ceiling, and thus keeps brightness contrast at approximately unity. The apertures which provide the uplight component also act as a ventilator, which in turn provides a self-cleaning action.

This lighting installation is typical of thousands of low bay lighting installations made over the past three or four years. No longer is 200 footcandles classed as a spectacular job, but as an accepted standard. Usually the same reflector equipment may also be used with 800-ma high output lamps, or even with 430-ma slimline lamps. Thus the lighting levels may be varied by the type of lamps used, by the spacing and mounting heights.

High level illumination with a minimum of glare is considered a necessity for the composing room of *The New York Times*, New York City newspaper. Therefore the area has been lighted to a level of 110 footcandles, maintained in service, and all luminaires have been equipped with louvers to shield the lamps and reflectors from view in the normal line of vision within the area.

The luminaires selected for lighting this area are Miller 2-lamp 1500-ma fluorescent units, with Alzak aluminum reflectors, top apertures for 25% upward light,

and equipped with egg-crate type louvers. The 25% upward component of light from the reflectors lights the ceiling to approximately the same brightness as the louver panels, so that brightness contrast is at a minimum. The ceiling is plaster, painted white, with a reflectance of 70%. Sidewalls are light green in color, having a reflectance of 60%. The floors are gray cement. The luminaires are installed in continuous rows, suspended 36 in. overall from the 14-ft high ceiling. Reflector rows are spaced 10 ft on centers, so that spacing and mounting heights are about equal.

**CONTINUOUS ROWS** of 2-lamp 1500-ma fluorescent luminaires, spaced 10 ft on centers, with reflectors louvered, provide 110 footcandles maintained in this newspaper composing room.





# COMMERCIAL LIGHTING

## I. OFFICE LIGHTING

**I**N 1960, the Illuminating Engineering Society published its latest and current "Recommended Practice For Office Lighting." This official IES recommended practice incorporates new illumination levels, based upon the best information available from the researches of many investigators, the Illuminating Engineering Research Institute.

The new illumination levels range from 30 footcandles for easy visual tasks (reading high contrast or well-printed material, conferring, interviewing, inactive files, etc.) to 200 footcandles for difficult visual tasks (detailed drafting, designing, cartography). The recommendation for regular office work is 100 footcandles, and for more severe visual tasks, such as accounting, auditing, tabulating, bookkeeping, etc., the recommended illumination level is 150 footcandles. In all cases, the footcandle values are "minimum" values on the visual tasks at any time. Thus, in designing a lighting system, higher initial lighting levels must be planned for, to compensate for light output depreciation as lamps grow dim through use, for absorption of light by surfaces on columns, walls, etc.

Other factors which are treated and discussed in this new recommended practice include direct and reflected glare, recommended reflectance values for ceilings, walls, floors, furniture, and office machines

and equipment, brightness and color contrasts, a direct glare limiting brightness guide for luminaires (popularly referred to as a "scissors" curve), and the influence of environmental factors. Lighting system designers and consulting electrical engineers generally are familiar with these various factors, and probably have a copy of this office lighting guide for reference when needed. The intent here is not to review these various factors in detail, but to point out that they do affect lighting comfort and quality, and should be taken into account in office lighting system layout and design.

Shown in the accompanying illustrations and case histories are some typical examples of current office lighting methods and practices. Space does not permit full coverage of the subject. But the examples shown are believed to be representative of current trends and good lighting practice.

Office lighting in general does not measure up to the lighting industry's recommended standards. The major reason for this seems to be that many of the new and recent office buildings are speculatively built for leasing of space to tenants, and lighting levels usually range from only 50 to 80 footcandles of general illumination in these buildings. On the other hand, many of the institutional type, or owner-

(Continued on page 104)

A lighting installation which meets the IES recommendations is that of the large drafting room for the American Electric Power Service Corp., New York City. This installation consists of Lightolier recessed 2-ft by 4-ft luminaires, each equipped with four 40-watt T12 fluorescent rapid start lamps, installed on 3-ft by 7-ft spacings. Luminaires are equipped with Corning No. 70 glass diffusing panels. The resulting illumination is 225 footcandles, maintained in service, except in spaces adjoining columns, where absorption of light by the columns reduces the illumination to 150 footcandles out to a point about 2 ft away from the columns. At inside wall areas, luminaires are installed on closer spacings, so that 225 footcandles are maintained.

The desk and drafting table layout was dictated by the lighting layout. Tables are arranged so that draftsmen face along the length of the luminaires, as luminaire brightness is less under this condition than when viewed crosswise. A light gray floor, plus reflected light from tracings and drawings, pro-

vide ample illumination on the 8-ft 6-in. acoustical ceiling so that brightness contrast between the ceiling and lighted units is visually comfortable for the 132 employees who occupy this room.

Drafting presents one of the most

difficult of visual tasks in office lighting. Thus the IES recommended minimum level of lighting for drafting has been set at 200 footcandles, the highest lighting level in the office lighting recommended practices.



**SEEING** is made easy and comfortable in this drafting room by 225 footcandles of illumination provided by 2-ft by 4-ft recessed luminaires equipped with four 40-watt fluorescent lamps each.

occupied buildings, are better lighted, and lighting levels in these range from 75 to 150 footcandles. Also, many modernized office buildings have installed good lighting as a benefit to be offered prospective tenants, or as a general property improvement. Some of the best office lighting installations are in modernized areas of older buildings.

One of the major current trends in office lighting is that of combining, or integrating, the lighting system with the air conditioning system. One solution to this problem is the "air handling troffer," a recessed fluorescent luminaire with which is combined air diffuser outlets or return air grilles. Other solutions include systems which remove heat from the lighting units directly, and pump it to the outside of the building, or which utilize the lighting

heat in cold weather. Many specific methods of solving the problem of heat in lighting have already been developed, and others are currently under study and consideration.

Because of the trend to higher lighting levels for office areas, another lighting design trend is to the use of large-area low-brightness units, either recessed or surface mounted. This approach aids in providing higher lighting levels, maximum visual comfort and a minimum of glare. Luminaires of the surface-mounting type are not much shallower. Also, they help to meet the problem of low ceiling heights.

Only a few years ago luminous ceilings were quite popular, ranging from wall-to-wall treatments to large panels of various geometric design arranged in artistic patterns. Luminous elements were (and still

Two new two-story office buildings in Seattle, Wash., recently completed and occupied by the Boeing Company's Aero-Space Division, have been lighted and air conditioned by 12,000 Benjamin combination-type "air-handling troffers," containing both lighting and air handling components. These two buildings contain approximately 340,000 sq ft of floor area.

Each building is based on a 5-ft design module in both directions. Each 5-ft by 5-ft module is equipped with a 1-ft by 4-ft combination lighting-air ventilation luminaire, recessed flush in the ceiling. Thus, a 10-ft by 15-ft space may be partitioned off, for example, which would contain six recessed luminaires that would provide ample lighting, ventilation and temperature control—all without requiring any changes in lighting or air conditioning equipment. These air-handling troffers were specified for these buildings because of the

primary consideration given to modular flexibility in design. Fire protection sprinklers are placed at 10-ft intervals as close as possible to the troffers.

Each lighting troffer contains three 40-watt T12 fluorescent rapid start lamps, and lights an area of 25 sq ft. A lighting design level of 100 footcandles was selected for this installation, and the lighting intensity was planned on the basis of the smaller office spaces, which are the least efficient from the standpoint of light utilization. This consideration determined the number of lamps to be used in each module, or in each troffer. Thus, in large office areas lighting levels are considerably above the 100-foot-candle design level.

This combination lighting-air conditioning system installed at Boeing is designed for both heating and cooling, in addition to lighting. However, because local winter temperatures in Seattle are not ex-

treme, the system will be used mainly for cooling and ventilation.

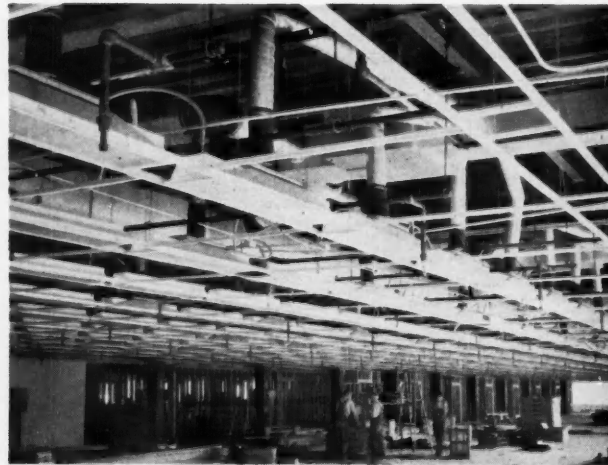
Glass diffusing panels were used in all troffers throughout the two buildings.

Individual troffers are each 4 ft long. Since the module dimension is 5 ft, the intervening space between any two units may be blanked off, or may be used for PA system speakers, adjustable incandescent reflector spots or floods, or other similar devices.

Since air conditioning requirements do not make it necessary to use each troffer as an air-handling device, about 40% of the troffers are connected to a ceiling duct system above the ceiling which brings in fresh air from a single air-conditioning unit on the roof of each building. Another 40% of the troffers are equipped with plenums through which used air is drawn, and similarly ducted to an exhaust system. The balance of the troffers is used for lighting only.

**AIR-HANDLING TROFFERS** installed on a 5-ft by 5-ft spacing provides over 100 footcandles and temperature control in this 340,000 sq ft office building.

**TROFFER INSTALLATION** details and connections to air ducts are shown below. On the outside row every troffer has an air connection. In second row, every other troffer is connected.



are) available in a wide range of materials, patterns, and designs, in louvers, corrugated plastics, and formed panels. More recently, the wall-to-wall treatments are less often selected. However, large-area luminous panels continue to be used for many special lighting treatments in office buildings, such as in board rooms, conference rooms, reception areas, large private offices, etc. In most instances, some design treatment is used which will provide individuality to the specific luminous panel design, or which will harmonize with the area decorative treatment.

Since the introduction of new type diffusing panels which polarize the light, many of the manufacturers of standard recessed troffer units have made polarizing panels available. The advantage of polarized light is that it helps to eliminate veiling reflected

glare. However, polarization is most effective within a relatively narrow range of angles of reflection (of the light from reflected glare surfaces), and polarization panels reduce light output excessively. This subject continues under research and study, and there does not seem to be any strong trend to the use of polarized lighting at this time.

There continues to be a trend to modular design of office building structures, and this construction trend is also affecting lighting system design. Modular treatment offers many benefits, particularly to the tenants of office areas, in that floor space can be utilized much more effectively. Thus, lighting equipment which can be used in modular structural design is necessary, and many installations have already been made. This trend should continue.

Through the years, one of the major problems encountered in the lighting of offices, school classrooms and similar areas has been that of reflected glare. Regardless of the types of equipment or the lighting systems used, the light projected onto desk tops, or books, magazines, industrial seeing tasks, etc., produces a sort of "veiling glare" as light is reflected from these surfaces.

Research and experiment have indicated that if light rays are polarized, this veiling glare can be reduced, more at some angles than at others, providing substantial improvement in light quality. Light polarization is now practical with

recently developed polarizing light panels which can be used in luminaires in place of standard diffusion or shielding panels.

A typical installation of polarized lighting is that installed in the drafting room of the Lockheed Aircraft Corp. plant, Marietta, Ga. In this installation, continuous rows of Day-Brite 2-ft by 4-ft recessed troffers, spaced on 10-ft centers, are used, equipped with polarizing light panels. The system provides a lighting level of 100 footcandles of glare-free and shadowless lighting, which the draftsmen found helpful and a distinct improvement over regular lighting systems frequently used in such areas.



**POLARIZING LIGHT PANELS** in standard 4-lamp recessed luminaires reduces veiling and glare and provides improved seeing in this drafting room.



**A LUMINOUS CEILING** using plastic louver panels lights this private office comfortably and effectively to an illumination level of 100 footcandles.

The lighting for private offices generally follows the lighting treatment used in adjoining general office areas, or in an entire office building when a specific lighting system is selected for the building. In many cases, however, special lighting treatments are desired, and a wide range of lighting layouts and types of equipment have been used for this purpose.

A typical example of special lighting for a private office is that used to light the Mayor's office in Tampa, Fla. In this office, which is approximately 18 ft by 22 ft, a luminous ceiling measuring 16 ft by 20 ft is used. The ceiling consists of Guth Gratelite panels, each 2 ft square, supported on a T-bar suspension system. Above these 3-in. cube louver panels fluorescent lamps are installed at a height of 26 in. above the panels. The system provides an illumination level of 100 footcandles of well-diffused light and a low brightness ceiling.



## 2. STORE LIGHTING

**G**OOD store lighting is an important sales tool. Its purpose is to attract customers, bring them into the store, and then to make it easy for the customers to see and appraise the merchandise. At the same time, it should help to create a visually comfortable, and esthetically pleasing atmosphere.

Store lighting methods and lighting techniques vary greatly, depending in part on the type and location of the store, and in part on the type and class of merchandise. Generally speaking, however, good store lighting should include these three basic components: 1) general lighting; 2) display lighting; and 3) perimeter lighting. For stores located in high level traffic areas, and where competition is keen, illumination levels should be high, to attract and hold the attention of prospective customers. In some types of stores, such as those with open top floor display cases, good horizontal lighting is important. But in other types of stores, such as food stores using vertical counter displays, high levels of vertical illumination are desirable.

Today's practice calls for general lighting levels of from 30 to 100 footcandles, for circulation areas and for appraisal of merchandise in clerk-served stores. Display lighting levels normally range from 75 to 200 and higher lighting levels—usually two to three times the general illumination levels, so that the merchandise will stand out sharply in contrast. Perimeter lighting can be used for two purposes, but should be two to three times the brightness of the general lighting level. One purpose is to light merchandise displayed along wall and other perimeter areas, and another is to raise the brightness of these wall areas to make the store appear wider and more bright and cheerful, and to help combat daylight reflections in glass windows.

Shown here are only a few typical examples of modern store lighting, since it is impractical to attempt a full roundup of the many store lighting techniques now in use. These examples illustrate some of the fundamental concepts of modern store lighting practice, however, and should be useful.



Shopping centers create new problems in store lighting, depending upon the design and layout of the centers, which vary greatly. For example, the Lenox Square Shopping Center, Atlanta, Ga., shown above, has a large mall between stores, open to sky in center, but covered over promenade area in front of stores. A huge parking

area completely surrounds the entire center, and stores thus have entrances both for the parking areas and for the mall.

In the store at left, typical store lighting methods are used. Adjustable 300-watt reflector lamps highlight the store front displays. General lighting is by means of 4-ft sq recessed fluorescent units, and

recessed incandescent downlights highlight feature displays. The sidewalls are lighted by a continuous fluorescent wall lighting unit, open at top and bottom. A decorative type incandescent luminaire is suspended from the ceiling.

Weatherproof incandescent units on columns and over front of stores light the promenade.



High level general lighting, averaging over 125 footcandles maintained throughout, makes the selection of food pleasant and easy in this Hinky Dinky food shop in Des Moines, Iowa.

The 15,120 sq ft store area is lighted by Guth 2-ft by 4-ft 4-lamp recessed troffers, equipped with Gratelite plastic louver diffusers, installed on 8-ft by 8-ft centers. Rear and side walls are washed with light from a continuous fluorescent wall bracket, which helps to

create a bright and cheerful interior, with the lighted wall down in the general field of view. Direct lighting incandescent recessed units are also used to light local areas where meats, vegetables, etc. are displayed, since these show up best, and present their true appearance under this type of light.

Note that floors are very light in color. This helps in the lighting of vertical displays by reflecting a high percentage of light back onto the merchandise.



In Wieboldt's State Street department store in Chicago, the first two floors have recently been relighted as part of a general modernization program for the entire store. The first floor has been relighted to a maintained illumination level of 130 footcandles, or about 13 times its former lighting level. The relighting on the second floor is to a maintained lighting level of 80 footcandles, or more than three times the former illumination.

The new lighting system consists of large-area low-brightness floating panels, suspended from the ceiling about 15 in. overall. Each panel is 6 ft wide by 12 ft long, open at top, and bottom and enclosed with 18 2-ft by 2-ft diffusing panels. Unit houses 1500-ma PG17 deluxe cool white fluorescent lamps, which



closely simulate the conditions of natural daylight, and permit more accurate appraisal of colors. Additional PAR-38 incandescent flood-

lamps are mounted at the corners of each rectangular panel, which add sparkle and glamour to the merchandise displays.

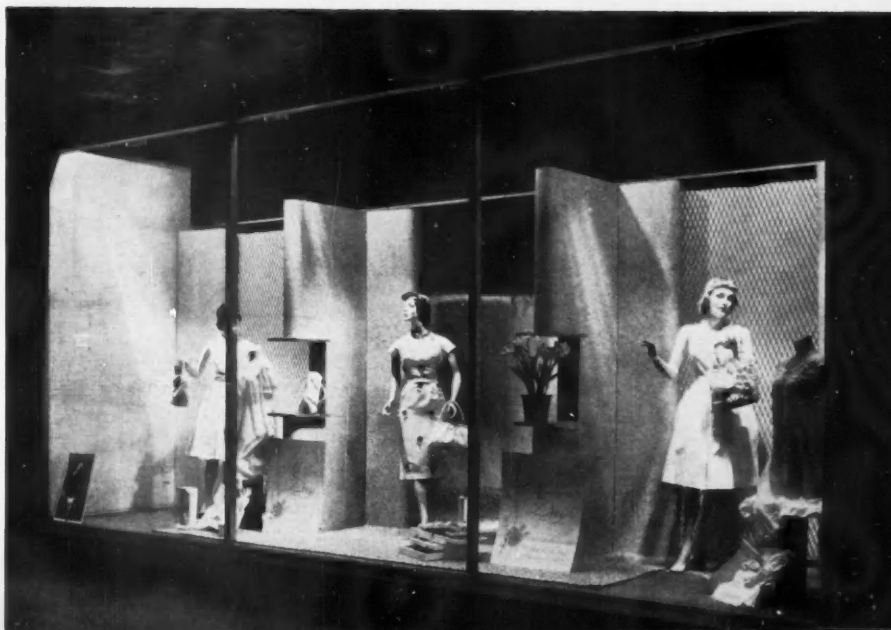
New types of incandescent lamps have been used to light show windows in the Carlisle-Allen Department Store, Ashtabula, Ohio.

In the show window illustrated, for example, six narrow spot and medium flood "Cool Beam" lamps are used, with the beams of two lamps directed to each of the three display figures. Built-in filter-reflectors in these new lamps remove two-thirds of the heat from the light beams. Reduction of the heat from these light beams helps to protect the merchandise and props from deterioration, reduces the fading of fabrics, and increases the comfort of the store's display staff.

General illumination is provided in this show window by four 500-watt quartz-iodine incandescent lamps. These new lamps are high in efficiency (22 lumens per watt), permit excellent light control when

used in properly designed reflector units, and maintain their efficiency throughout their 2000-hr normal operating life.

This installation provides an excellent example of combined general illumination and spot lighting for show windows.



# RESIDENTIAL LIGHTING

**I**N THE United States, which boasts of the highest standard of living in the world, it is ironic at least that residential lighting practice continues to trail residential lighting technology and "know how" by a wider margin than in any other field of lighting. In the field of home building construction, a much smaller percentage of the total construction dollar goes into lighting equipment than in any other type of building construction.

What are the trends in residential lighting in current practice, and what constitutes some of the advanced technology in home lighting practice?

As for current residential lighting practice, the lighting for low-cost and median-range-cost homes in general is substandard—a minimum of lighting units of decidedly poor quality, and lacking in features of good lighting design. In higher-priced houses, more units may be used, and the quality of the units may be a little better, but even here the incorporation of good lighting features is usually lacking. And all too often this also applies even to custom-designed houses.

On the other hand, through the efforts of the Medallion Home program and other industry programs, better lighting systems are being recommended in an increasing number of new homes, usually in the homes costing \$20,000 and above. Also,

more and more home builders are beginning to recognize the added sales benefits of better lighted homes. Some few builders have even featured "Light for Living" in model houses, and made provisions for incorporating any specific lighting treatments selected by the prospective home buyers. Through this approach, some progress in home lighting is beginning to be made.

In today's better lighted homes, the trends are to the use of some type of exterior lighting for the entrance and front of the house, to the use of ceiling luminaires of good lighting design in all rooms of the house, to the use of recessed downlights and adjustable flood or spotlights for mood lighting in many areas of the home, and to the use of more structural lighting features, such as luminous ceilings, luminous wall panels, lighted valances, wall brackets, cornices, coves, room dividers and similar treatment.

All of these lighting treatments and many more are carefully detailed and discussed in the Illuminating Engineering Society's booklet, "Lighting—Keyed to Today's Homes," and in the literature of many manufacturers of residential lighting equipment, light sources, incandescent and fluorescent lamp dimmers, lighting accessories and components. Some of these devices are also shown in the accompanying illustrations.



Light and lighting flexibility add to the charm and livability of this living room. Recessed eye-ball lights are focused on entrance hall wall mural. Directional eye-ball lights in sunken living room high-light decorative lattice and seating

area. Use of pulldown and pendant cluster decorates and illuminates the conversation area, which is also lighted by recessed downlights. Lighting units are arranged in three appropriate groups, and each group is dimmer-controlled for full

lighting flexibility. The lighting, by Moe Light, is a feature of this \$13,500 model home, built and exhibited by Sidney Golen, builder and developer in St. Petersburg, Fla. It is aptly referred to as a "House of Ideas."



Lighting requirements for the average kitchen is for a uniformly distributed general illumination of 50 footcandles or more, and for supplementary local lighting over food preparation areas, the stove, and on tables and counter tops. Ceiling luminaires are normally used to provide general illumination, under-cabinet units usually provide local lighting on counter tops, and direct lighting units are appropriate for tables and sinks.

In the beamed colonial kitchen shown in the illustration above, general illumination is provided in the 10-ft by 12-ft area by a fluorescent wall cove over range wall, and by recessed fluorescent panels in the hollowed ceiling beams. Fluorescent lamps are also installed beneath cabinets for countertop lighting. Two 75-watt R30 floodlamps light the color-patterned windows, and a single floodlamp is directed toward the range.



Structural or "built-in" lighting treatments add a custom lighting appearance, and are appropriate for modestly priced homes, as well as for more expensive custom-built homes. Two of the many popular structural lighting techniques available are used in the dining room illustrated above. Fluorescent lamps concealed behind the opaque cornice light the draperies, while a single 4-ft fluorescent lamp concealed behind a high mounted wall bracket lights the sideboard and picture. A typical pulldown pendant provides excellent illumination over the dining table.



The basic requirements for lighting a bathroom are for general lighting from an overhead light unit, and for local lighting from each side of the mirror over the wash basin. The tub or shower area should also be lighted separately by overhead light unit.

In the illustration at left, general illumination is provided by a large area luminous panel built into the ceiling, and lighted by fluorescent lamps concealed above. Local lighting for the wall mirror is provided by two lantern-type brackets using incandescent lamps. The shower is lighted by a ceiling-mounted unit.

The barest essentials for lighting in a bedroom are an overhead ceiling light, a light at the head of the bed, and lighting at the dressing table. Additional lighting is desirable, but the types of lighting and uses would be influenced by the living habits of those using the room. For example, students might want study lighting if the bedroom is used for studying. This would call for higher lighting levels.

In the Colen "House of Ideas" exhibit house in St. Petersburg, Fla., the master bedroom lighting is shown in the accompanying

photo. Note that four types of luminaires are installed in the ceiling. First is the center ceiling outlet, equipped with a six-lamp cluster of low wattage lamps. Second is a group of four recessed pinhole downlights. Third is the use of two recessed diffuse lighting downlights, and fourth are the two pulldown luminaires, one for a night stand on each side of the head of the bed. A table lamp is used on the dresser alongside the wall mirror. These are all lighting ideas which are applicable for bedroom lighting.





# INSTITUTIONAL LIGHTING

**T**HE lighting of institutional buildings such as schools, hospitals, libraries, art museums, churches and banks involves essentially the same basic lighting principles as commercial lighting or the lighting of offices, drafting rooms, board rooms, conference rooms, reception areas, and similar areas. In general, the same types of commercial lighting equipment are also used, and may be either mass-produced commercial-type luminaires, or custom-designed and built equipment. The lighting equipment for churches and for some areas of hospitals may also be special application types of units, such as "lanterns" for churches or "ward lighting units" for hospitals.

The problems involved in school lighting, for example, are practically identical to those involved in office lighting. In both cases, visual tasks such as reading, writing and drafting are similar. The Illuminating Engineering Society has only recently approved and published a new School Lighting Guide treating the problems of lighting for the various seeing tasks in schools which should be followed as closely as possible by lighting engineers and others involved in school lighting design. The recommended illumination level for school classrooms is 70 footcandles, and the recommendations for handling the problems of direct and reflected (veiling) glare are the same as in office lighting practice.

In lighting banks, much of the lighting problem is that of office lighting, plus the lighting of the public and main banking areas. In solving the lighting for public and main banking areas, current practice is to follow the principles of good lighting practice,

and to stress esthetic and decorative considerations. Architects and lighting engineers both attempt to provide individuality in the lighting of these areas for each bank lighting installation.

Hospital lighting practice involves lighting for office and public areas, which are usually handled about the same as office and public areas in office buildings. It also involves the lighting of such areas as operating rooms, public and private ward rooms, X-ray and other types of laboratories, corridors, nurses' stations, etc. Special lighting equipments and lighting techniques are normally used for these areas, specifically designed to meet the particular problems involved.

In libraries and art museums the accent is usually on vertical surface lighting insofar as lighting design is concerned, and many lighting design techniques have been developed and used for this purpose. The lighting of reading rooms in libraries involves problems similar to those which exist in offices and school classrooms and should be handled accordingly.

Church lighting presents its own peculiar problems, and each church lighting layout should be developed specifically to meet the particular lighting problems involved. Current lighting practice ranges from the use of the traditional-type lanterns to downlight, cove lighting and special treatments.

Institutional lighting is too broad in scope to be covered in detail here. All that can be done in the limited space available is to present some typical examples which show current good lighting practice and indicate the range of lighting techniques currently being used.

The New Admiral King High School, Lorain, Ohio, has provided IES-recommended lighting levels throughout its 60 classrooms and 15 special training and educational rooms for art, dramatics, drafting, etc. Lighting levels range from 70 footcandles maintained in class-

rooms to 100 footcandles in the sewing room, and 110 footcandles in the mechanical drawing room. It has met the three primary objectives which were set before the lighting system was designed, which were: 1) comfortable visual environments throughout; 2) IES-

recommended lighting levels in all areas; and 3) ease and simplicity of lamp and luminaire maintenance.

In order to meet the lighting objectives, the architects and engineers selected Wakefield Grenadier II luminaires as the basic lighting unit. This is a suspended direct-indirect 2-lamp fluorescent luminaire, with translucent plastic side panels, and metal louvers with 35-degree by 25-degree shielding. Units are installed in continuous rows and suspended 12 in. overall. Light distribution is approximately 50% upward component and 50% direct lighting component. The upward component lights the ceiling softly, and the luminous side panels reduce brightness contrast against the lighted ceiling. Continuous rows are spaced on 6-ft to 9-ft centers, depending upon room size and lighting level desired.

In the mathematics classroom shown in the illustration, three continuous rows, each 20 ft long, are spaced on 9-ft centers to light the 24-ft by 30-ft area to 70 fc.





An interesting new approach to classroom lighting, especially from the standpoint of lighting equipment layout, has been used in the Oak Street School, Inglewood, Calif. The luminaires are Smoot-Holman single-channel units, open at top, and enclosed at bottom with combination diffuser and lens panels for brightness control. These single-channel units house a single 1500-ma PG17 fluorescent lamp along its length, plus a 2-lamp ballast (dark panel in bottom of channel), and are suspended about 27 in. from the ceiling. Ceiling heights are ample to permit use of this suspended unit. These single-channel units are arranged in a square pattern around the perimeter of the room, measuring ap-

proximately 20 ft on each side of the classroom.

Light output from this unit is semi-indirect in type of light distribution, with a majority of the light being directed to the white ceiling. Thus, some direct light from the bottom diffusing panels lights the desk tops throughout the classroom, and this lighting is supplemented by diffused indirect light from the ceiling and side walls.

The initial level of illumination averaged 80 footcandles, varying from 90 footcandles directly under the luminaire channels to 70 footcandles at the walls, and with 80 footcandles at the center of the room. This layout is simple in character, and equipment is easy to install and maintain.



Classrooms at the new University of Wisconsin extension, Wausau, Wis., are provided with a general lighting level of 95 footcandles on

desk tops, and 55 footcandles on vertical surfaces, including the chalkboards. These lighting levels are "maintained" values, having

been determined after the building was in operation for one year.

This high-level, visually comfortable classroom lighting is provided by Day-Brite Luvex all-metal 2-lamp fluorescent luminaires. These direct-indirect units have 35-by 25-degree shielding, are installed in continuous rows, and are suspended about 10 in. from the ceiling to the top of the units. Over half of the light output from these units is directed to the white acoustical ceiling, and is indirectly reflected back into the classroom to provide maximum diffusion. The direct lighting component is effectively shielded against direct glare by the white metal louvers, metal side panels and center metal reflector-shield. Lamps used are 4-ft 430-ma type T12 rapid-start fluorescent lamps.

The Rubidoux Library, Riverside, Calif., has achieved a custom-design lighting layout, using a standard-design fluorescent luminaire, in addition to a high-level illumination of 100 footcandles and an attractive and comfortable visual environment.

The library is square, with a sloping roof on all four sides which extends out beyond the four glass upper walls. To provide lighting for this unusual structure, Smoot-Holman semi-indirect suspended fluorescent luminaires were selected. These luminaires, which have a small 5-in.-sq metal channel, open

at top and enclosed at bottom with a diffusing panel, are designed for use with single 800-ma fluorescent lamps run continuously in the channel. These channels have been arranged in concentric squares and suspended from the white sloping roof. The concentric squares increase in dimensions from the top square to the bottom square. As shown in the accompanying illustration, these units continue to the outside of the building and create an individual and unusual lighting design treatment. Decorative-type direct-lighting incandescent units suspend from the center of the roof.



Fluorescent luminaires equipped with 8-ft 1500-ma type PG17 fluorescent lamps have been used to light the new gymnasium at Dean Junior College, Franklin, Mass. The maintained lighting level is 50 foot-candles.

The 56-ft by 103-ft gymnasium is lighted by 28 Miller Imperial fluorescent luminaires. These units have white porcelain-enameled metal reflectors, are equipped with open slots to provide 25% uplight, and are equipped with wire guards. Mounting height is 18 ft from the floor, which places the bottom of the reflectors at the same level as the bottom of the steel beams in the open truss-work construction. The 21-ft high ceiling is painted



white, which is softly illuminated by the uplight from the units, and thereby reduces brightness contrast between the lighted reflectors

and the ceiling above. The ceiling is gypsum, with an 80% reflection factor. Spacing of units is 12 ft by 10 ft.



The lighting of hospital rooms has long been a problem for lighting engineers, in that the lighting must be flexible and also meet multiple requirements.



**TWO-LAMP** ward lighting unit provides both indirect and direct lighting, with the direct lighting lamp switched separately. In picture at left, both lamps are on. Above, indirect lighting only is on.

The St. Mary of Nazarene Hospital in Chicago has recently re-lighted private, semi-private and ward rooms with a wall-mounted, totally enclosed 2-lamp fluorescent

luminaire which meets these requirements most satisfactorily. The unit used is the Day-Brite Tranquillite, each of which is equipped with two 40-watt T12 rapid-start fluorescent lamps. A single 2-lamp unit is installed on the wall over the head of each hospital bed. One lamp provides an upward indirect light and the other, separately controlled by a pull-type switch, provides direct lighting. The luminaire also has a grounding-type receptacle for use in plugging in a portable hand lamp by the nurse or doctor when required. The top lamp provides a soft, low-level light for general room illumination, and the bottom lamp may be turned on by the patient to provide light for reading or eating or for the nurse's use. Maintenance is simple, since the unit is totally enclosed and may be wiped clean with a dust cloth each day.



Typical of many of the churches being built today is the First Covenant Church, Omaha, Neb., illustrated here. Typical also is the lighting—two rows of Manning suspended lantern-type luminaires.

The pendant luminaires are simple in design, and consist of a Plexiglas plastic diffusing cylinder with spun aluminum trim. The cylinder is lighted by 60-watt lamps. In the bottom of each cylinder is a 500-watt lamp in a suitable reflector which lights the pews below. This bottom reflector is shielded with 45-degree cutoff

louvers to prevent direct glare. A lighting level of 20 footcandles results throughout the main nave.

The cross at the altar is lighted with a neon tube, and concealed 150-watt reflector lamps provide additional light to accent the sanctuary.

In the lighting of churches, each church should be considered individually, and a lighting system should be selected which solves the specific lighting problems presented and harmonizes architecturally and esthetically with the design of the church involved.

# OUTDOOR LIGHTING



## I. FLOODLIGHTING

**O**UTDOOR lighting is today making great strides. Its growth rate is rapidly outpacing that of any other type of lighting. Americans, with more leisure time at their disposal, are moving outdoors. And, through the use of outdoor lighting, they are now turning once-wasted nighttime hours into useful time. They are now utilizing more fully than ever before the many facilities for all types of outdoor activities.

Outdoor lighting has many end-use applications—both utilitarian and decorative. Also, outdoor lighting uses many types of lighting equipment, and a wide range of lighting techniques. Thus, considerable confusion exists in terminology and in attempts at classification of outdoor lighting. For example, "floodlights" are used to floodlight a building, or a monument, whose end-use application may be defined as "architectural" or "monumental" floodlighting. But "floodlights" are also used to light parking areas, for example, which may also be lighted by any of a variety of other types of outdoor lighting equipment. Similarly, the exterior surfaces of buildings may be "flooded" with light by means of other types of lighting equipment than "floodlights." This confusion will probably continue until the industry decides that a clarification of terminology is necessary for improved

market development, or for some other valid reason.

Outdoor lighting is arbitrarily divided into two classifications here for this presentation—1) Floodlighting, and 2) Area Lighting. These are broad end-use classifications, which seem to have some merit. Floodlighting, for example, may be done with "floodlights," or with other types of equipment. Similarly, area lighting may be done with floodlights, or any of a wide range of other types of equipment. The editorial objective here is to review some of the current trends in outdoor lighting practice, and to indicate that a huge market exists for outdoor lighting, in a broad range of end-use applications, and through the use of a wide variety of outdoor lighting equipments, lighting techniques and methods.

The lighting of streets, highways, bridges, tunnels, viaducts, etc. is also a part of outdoor lighting activity, but is not treated here as a separate subject, as space will not permit a detailed discussion. The same types of street and highway lighting equipment, however, may also be used for many area lighting projects, and points up the need for considering all types of outdoor lighting equipment when planning the lighting for any outdoor lighting application. Outdoor lighting technology is already well advanced, but further progress seems assured.

A well-known American landmark is the Washington Monument, in the nation's capital. This famed 555-ft-high spire is lighted on all sides by a total of 120 heavy-duty type Crouse-Hinds incandescent lamp floodlights. The lower part of this monument is lighted by 20/200-watt units and 16/500-watt units, positioned around the base. These units are recessed in specially constructed pits, which are closed over during the day and opened at nighttime. Thus the floodlights are concealed from the view of visitors during the day, but are made ready for operation at night by merely opening the pit covers. The upper portion of the monument is floodlighted by 84 floodlight units installed 110 ft out from the base of the monument in equal groups of four. These include: 8/1000-watt units; 16/500-watt units; 20/1500-watt units; 4/2000-watt units; and 36/1000-watt units equipped with 30-volt aviation service lamps. These units of different wattage sizes, and with different beam spread characteristics, were carefully selected to give a uniformly lighted spire, increasing in intensity gradually from base to top.

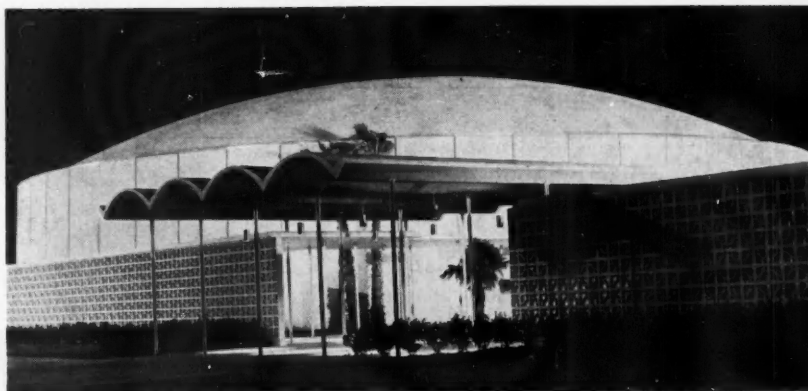






An unusual floodlighting technique was used to highlight the beauty of the Saks Fifth Avenue Branch store in Garden City, N. Y. It consists of the use of Sylvania aperture fluorescent reflector luminaires, which were concealed in the plaster ceilings where a 12-in. slot, adjacent to the wall area, allowed the light to project down over the walls. The luminaires, each containing a high-efficiency aperture fluorescent lamp, were installed with the light center only 8 in. above the inside ceiling level, and adjusted so that the maximum candle power of the light beam was directed to the bottom part of the wall area. Special cast aluminum mounting brackets were used to satisfy the unusual building configuration at the point of attachment. This wall-washing floodlighting technique provides 20 footcandles of illumination on the walls, and has the effect of accenting the "rubble wall," while adequate light also provides safety.

The unique design features of the building which houses the television studios of Station KTRK-TV in Houston, Texas, are effectively revealed and accented by mercury vapor floodlighting. The building is round, with a shallow roof of hemispherical design. Floodlighting is accomplished with 19/1000-watt Wide-Lite floodlights, whose smoothly distributed light patterns bring out the sparkling beauty of the white onyx and blue tile exterior of the building at night. Two floodlights are mounted on the roof of a one-story wing to the right of the circular structure, two are located at ground level, and the remaining 15 units are mounted on steel poles around the periphery of



the property. The inherent beauty of this unusual building design is even more striking at night, accented by means of the floodlight-

ing and color quality of the mercury lamps, than it is as seen by daylight. Flood lighting enhances the sculptured building interior.



The stately beauty of the Washington State Capitol, Olympia, Wash., is not only revealed, but also enhanced, by floodlighting, making it visible to residents and visitors at night as well as during the day. Considered to be one of the most beautiful of the state Capitols, the building's dignity is retained and highlighted through the creative use of mercury vapor floodlights.

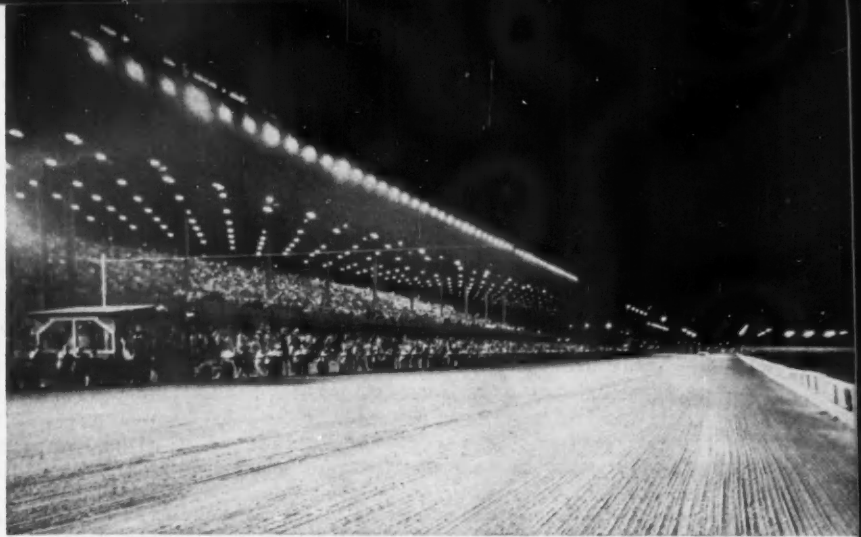
The units used are Wide-Lite 1000-watt floodlights. Three types

of mercury vapor lamps are used—color-corrected, clear, and silver white. The floodlights are mounted on masts anchored in concrete, and the units and their integrally mounted ballasts are grouped in multiples. The difference in the colors of the three types of lamps, plus the ability to precisely aim the light beams of the units, has made it possible to achieve a most dramatic lighting effect and nighttime appearance.



A new light source that is finding increasing acceptance for floodlighting applications has been used to provide an average of 30 footcandles on the raceway at Chicago's Sportsman's Park. It is the new quartz-iodine incandescent lamp, which has a 2000-hr rated average life, and produces 22 lumens per watt throughout its life.

In the Sportsman's Park floodlighting installation, 327 lamps of the 1500-watt size, installed in new General Electric Quartzline floodlights, were used. Because the quartz-iodine lamp is pencil-thin ( $\frac{3}{8}$ -in. diameter tube), its light output can be accurately controlled into a wide spread narrow beam, ideally suitable for such lighting applications as this harness racing track. All the light is directed to the track area, with very little spill



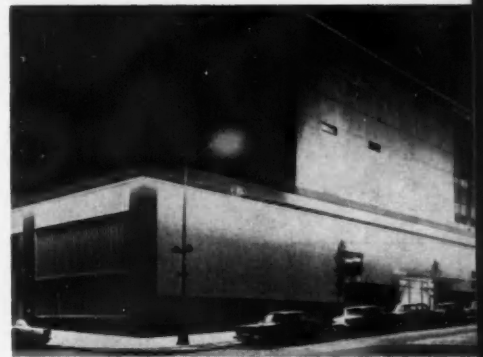
light outside the projected light beam. These floodlights were installed around the entire track, and were mounted on 30-foot poles, and

on the roof of the grandstand. These 1500-watt units can be operated on 240 or 277 volts, reducing wiring costs to a minimum.

A recently completed substation of the Consolidated Edison Co. of New York, Inc., New York City, located in the new Lincoln Center project area, is floodlighted for utility and for identification. Custom-designed lighting equipment was used, which consists of a Simes special metal housing which forms a cornice that becomes part of the architectural design of the structure. Over the one-story section facades, two rows of type T12 fluorescent lamps concealed in a reflector and above metal louvers, in

the bottom face of the cornice, wash the face of the building with light. Over a two-story section facade, the same cornice continues across the front of the building. This section of the cornice, however, also contains 150-watt reflector lamps, spaced 6-in. on centers, which light the upper story face of the building.

By using this type of equipment, it becomes a part of the architectural design of the structure, and eliminates the need for permission to locate floodlights elsewhere.



One of the problems of merchants in metropolitan areas has been that of keeping shoppers in the congested downtown areas. The shoppers, instead, have followed the trend to suburbia, and do their shopping in the branch stores which have been built in suburban areas by many of the downtown merchants.

Merchants in some cities have met this problem by creating an attractive downtown "mall," free from vehicular traffic, and designed for the comfort and pleasure of the prospective shoppers. One such project is that of the Lincoln Road Mall, in Miami Beach, Fla. Here the Lincoln Road merchants have combined their efforts and blocked off several squares of Lincoln Road, and equipped it with benches, shrubbery and floodlighting, covered lounge areas, color-lighted

fountains, bazaars, etc. Typical of these attractive features is the illuminated fountain shown in the accompanying photo, lighted by 500-watt PAR 64 narrow spot beam

lamps in Simes cast bronze water-tight housings. Foliage is lighted by the overhead mercury vapor units shown at upper right beyond the fountain.



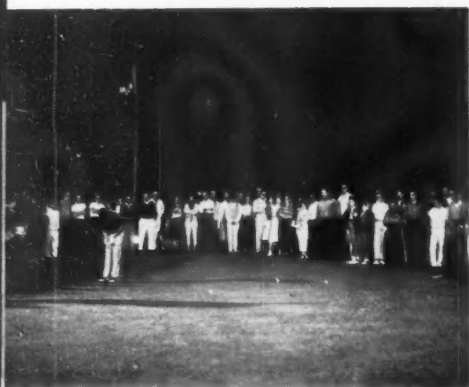
## AREA LIGHTING

**I**N A STRICT sense, any outdoor lighting application in which light is projected from a luminaire to an area is an example of "area lighting." However, the term "street lighting," which would also include highway lighting by this definition, is so well entrenched that it is arbitrarily omitted from the term "area lighting" in this discussion. Also, since the term "floodlighting" is normally associated with building structures, monuments, and similar lighting applications, this type of outdoor lighting has been discussed in the three previous pages under the subject of "Floodlighting." This section on "Area Lighting", therefore, covers all other types of outdoor lighting.

Some of the end-use applications for "area lighting" include: gasoline service stations, outdoor advertising signs, outdoor construction projects, swimming pools, parking lots, used car lots, lighting for

protection, freight yards, loading docks and platforms, airport aprons and passenger loading areas, piers, marinas, recreational areas and playgrounds, athletic areas such as baseball fields, football fields, ice skating ponds and rinks, tennis courts, lighted fountains, gardens, and many more. When one considers the many lighting problems presented in such a wide variety of applications, it becomes readily apparent that a wide range of types of lighting equipment is also called for. Such equipments exist today, and manufacturers of outdoor lighting equipment are constantly bringing out new designs. Many of these new designs incorporate new types of light sources which provide longer lamp life, more accurate light control, better color quality, and other benefits.

Outdoor lighting is rapidly becoming an exciting and dramatic new field, and promises new and expanded growth both for the present and in the future.



More and more golf courses are now being lighted, extending the hours which this popular sport may be enjoyed. The availability of new light sources with longer lamp life and higher efficiencies is making golf course lighting more economical, and hence more desirable. Lighting for golf driving ranges has long been practical and popular, and now the same may be said for par-3 courses and larger courses.

The Colonial Palms Golf Course in Miami, Fla., is a typical example. This 3400-yd, 18-hole, par-4 golf

course, shown in the accompanying photo, is lighted by color-corrected mercury vapor lamps, which produce ten footcandles of illumination on the greens, six footcandles on the tees, and three footcandles on the fairways. A total of 123 Wide-Lite floodlights, using 400-watt and 1000-watt mercury lamps, are mounted in palm trees strategically planted around the course. This was the first large golf course, reportedly, to hold an exhibition match between teams touring professional golfers under a system of artificial lighting.

Historically, new lighting techniques and designs come out of World's Fairs. The Seattle World's Fair is no exception. One of the innovations in outdoor lighting which is being used at the Seattle Fair is a new General Electric fluorescent luminaire, which is being used in clusters of two or three, in various colors, and at different heights and angles. These variations eliminate the commonplace treatment of single poles and present a dramatic appearance.

At Seattle the new luminaires are mounted at 16, 18 and 20 ft, each on its own pole, and are in coral, bieve, aqua, gold and blue colors. Each luminaire employs a single 4-ft fluorescent lamp which emits 70 lumens per watt and has a life of 9000 hours in normal service.

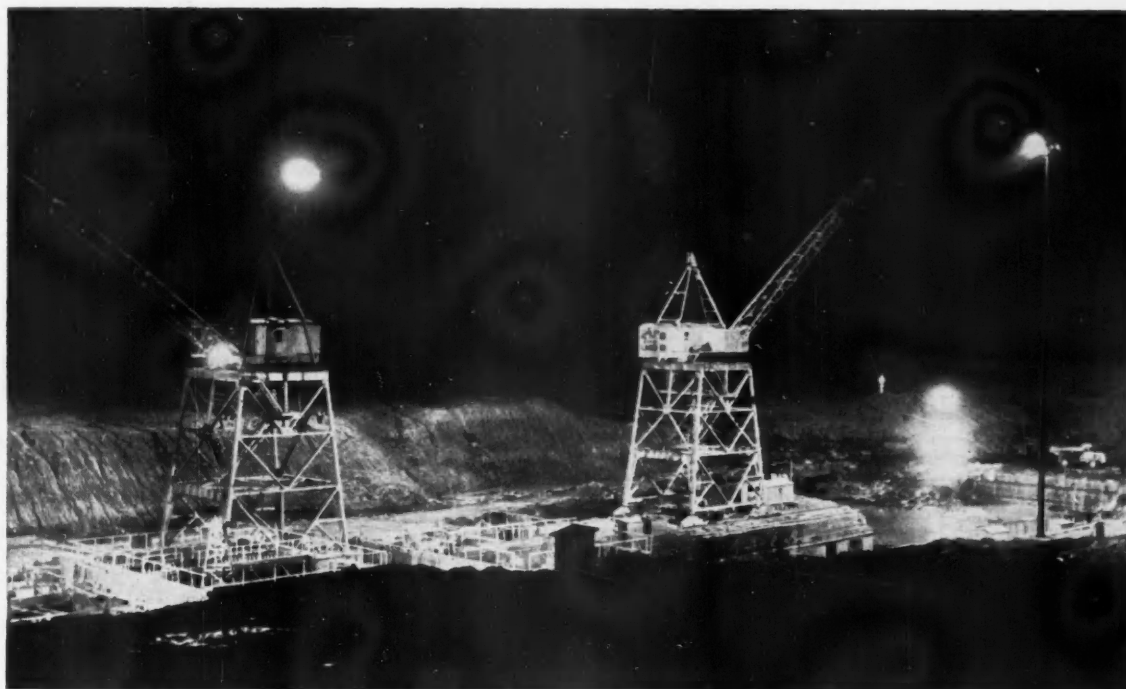


Outdoor-type reflector lamps, in sizes ranging from 150 to 500 watts, have been in use for area lighting purposes for several years. These lamps are merely screwed into weatherproof-type lamp holders on adjustable bases, mounted on poles, buildings, trees or other objects, and directed to the lighted area.

The same technique, but on a much enlarged scale, was used to light the new Chavez Ravine "Dodger" Stadium in Los Angeles. Under the direction of the illuminating engineer for the project, J. S. Hamel, a new lamp with features developed specifically for this project, was developed and made by Radiant Lamp Company. The lamp is made of Pyrex glass, in an R80 bulb size with a silver-coated reflecting surface. It is a 1200-watt size, for operation at 120 volts, and has a designed life rating of 1500 hours without sacrifice of lamp efficiency. The lamp produces a narrow

beam spread of approximately 20 degrees. A total of 1584 lamps were used, mounted in inexpensive fixtures, and installed in six towers mounted on the roofs of the sta-

dium, plus two more towers located in the outfield. The resulting lighting level is 260 footcandles average on the infield, and 170 footcandles on the outfield.



Floodlighting may be used for strictly utilitarian purposes, as well as for decorative and esthetic purposes. One such utilitarian use is that of "area lighting" for construction work.

On the St. Lawrence Seaway

project in New York State, an entire 490,000 sq ft construction site was area lighted to enable night work to be done. An average illumination level of one footcandle was provided for this purpose, by tower-mounted floodlights. Four 100-ft

towers were used, each equipped with eleven Crouse-Hinds general purpose floodlights with medium spread lenses, and with a 1000-watt type A-H15 clear mercury vapor lamp in each floodlight. Each lamp has a 460-volt series ballast.





The trend in shopping center design is to modern, efficient and attractive buildings, and to clean, well-kept surroundings. Since most shopping centers are surrounded by

parking areas, for the convenience of the shoppers, the lighting of parking areas is of special importance. The lighting system should be neat and attractive in appear-

ance by day, and should maintain a similar appearance by night when it is in operation.

The SCOA Shopping Center in West Covina, Calif., is typical of a modern shopping center. The neat clean lines of the building are maintained in the luminaires selected for lighting the parking areas. Styled mercury vapor luminaires, by Line Material Co., are installed on steel poles at a mounting height of 32 ft. Spacing between poles is 110 ft. There are 37 twin-unit luminaires, and 7 single-unit luminaires. Each unit uses a 1000-watt white mercury vapor lamp, producing 42,000 lumens. The lighting result is 4 footcandles average over the shopping center's entire parking area.



The new quartz-iodine incandescent lamp, with its 2000-hr rated life, maintained efficiency of 22 lumens per watt throughout its life, and small size which permits accurate light beam control, is proving to be popular for sports lighting. A typical application is that of the Brooklyn High School athletic field, Brooklyn, Mich.

This high school football field is evenly lit with a minimum of light spill beyond the edges of the playing field. This indicates that the total light output of the lamps is being directed onto the field, through accurate beam control, and that the glare is reduced to a very low value insofar as the spectators are concerned. The installation consists of 84/1500-watt Appleton Quartzlite floodlights, installed on six poles, with 14 floodlights per pole.

A requirement for the lighting of passenger loading ramps and apron lighting at airport terminals is that high levels of illumination be provided, with sharp light cutoff

angles for the visual comfort and convenience of the pilots, and for safety reasons. These lighting requirements and glare problems have been solved at Boston's Logan Air-

port by using Sylvania Controlled Fluorescent Reflector (CFR) luminaires.

The CFR luminaires are installed horizontally on 30-ft centers, 18-ft 6-in. above the pavement, and adjusted to throw the maximum light in the area between 60 and 90 ft out from the building on the ramp. The sharp light cutoff built into the optical system of this luminaire permits pilots to taxi to the unloading areas with adequate, glare-free illumination. A total of 234 luminaires are used at the Logan Airport installation to provide the required high level of illumination.





## Residential Swimming Pool Features . . .

# Around-the-Clock Safety Systems

An electronic pool alarm, 12-volt underwater lighting, and sound installation methods head a host of new safety techniques, which provide 24-hour protection for pool owners and bathers.

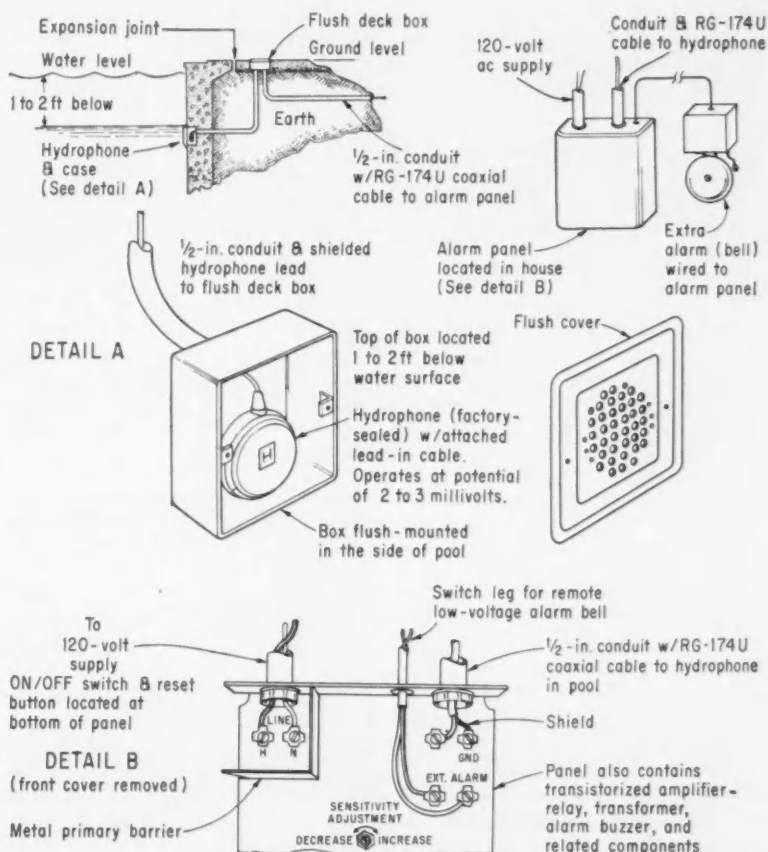
By J. H. Watt

**T**HE recently completed swimming pool at the residence of Mr. and Mrs. Todd P. Curtis, Locust Valley, L. I., N. Y., highlights a number of important new advances in electrical safety. At the same time, this installation proves that safety-conscious pool owners are keenly aware of the advantages offered by quality electrical equipment and systems.

Prior to construction, the pool builder, Welding Swimming Pool Co. Inc., Westbury, N. Y., together with their electrical contractor, Art Levene Electric Co., met with the owner to discuss the various electrical and mechanical systems that are available for use with pools. At this meeting the discussion included available types of underwater lighting, filtering and circulating equipment, and the various means of protection when the pool is left unattended.

Aided by such a conference, the owner selected an electronic pool alarm to detect unauthorized pool users. He also chose 12-volt underwater lighting because of reduced shock hazards at this voltage. And in addition, he approved the suggestion of the electrical contractor that sufficient underground feeder capacity be installed to handle future loads for a pool-side cabana, which will be constructed later on.

The electronic pool alarm system consists of a hydrophone in



**FIG. 1**—Electronic pool alarm keeps tabs on unattended swimming pools. Drawing shows system components and method of installation. The transistorized alarm panel, located at the house, contains an amplifier-relay that triggers warning devices when an underwater hydrophone detects any predetermined weight falling into the pool. When authorized bathers use the pool the alarm is turned off.

the pool, an alarm panel at the house, and an auxiliary bell that rings instantly should anyone fall or jump into the water when the pool is not under the watchful eye of a supervisor. With this novel arrangement the alarm circuit is turned off when authorized persons use the pool, in which case it is not possible to receive an electric shock in the pool from this equipment. Moreover, there is little chance of shock hazard when the pool alarm is in operation because the underwater hydrophone operates on a potential of two to three millivolts.

To operate the system while the pool is unattended, an externally operable switch, mounted on the house alarm panel, is turned on. This energizes the 120-volt supply to the unit and closes the transistorized amplifier-relay, which in turn operates a buzzer inside the alarm case. At the same time, the relay closes the SP switch-leg contacts of an external bell circuit, which rings an outside warning bell so that persons inside or outside of the house will be alerted. In addition to notifying others that the pool alarm system is to be in use, the operation of the buzzer and

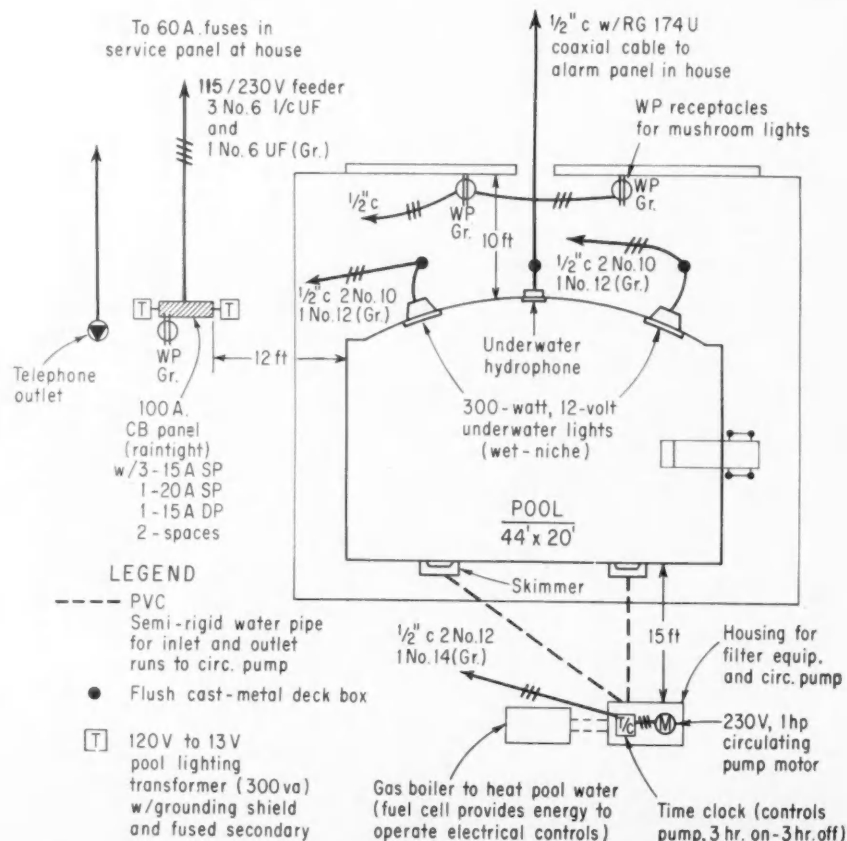
bell indicates that these warning devices are in working order. The next step is to push a reset button located next to the ON-OFF circuit switch on the alarm panel. This shuts off the buzzer and bell and fixes the unit for automatic operation. Thereafter, the band-pass filter to the amplifier will only conduct currents at frequencies that range from 1500 to 4000 cps. As a result, low frequencies (from activities outside the pool), or high-frequency radio waves, will not cause a "nuisance alarm."

While the system can be adjusted to detect even a hand splashing in the water of the pool, the gain-control calibration screw inside the alarm case is usually set at an adjustment level that will sense any object of 25 lbs or more that may fall into the water. According to Art Levene, owner of Levene Electric Co., the reason this weight has been selected is that it represents the average size of a baby that could crawl to the pool. Also at a less-sensitive gain-control setting, low-flying aircraft or nearby automotive traffic will not trigger the alarm.

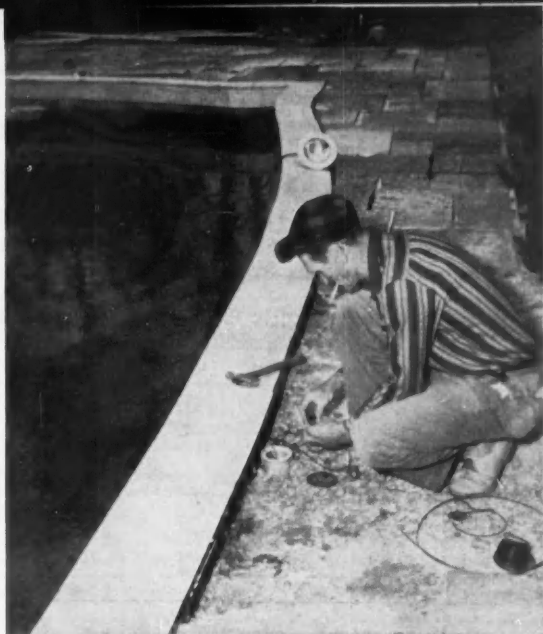
With the alarm system set for

automatic operation, a watertight sealed hydrophone in the pool will detect any predetermined weight falling into the pool. As an object penetrates the surface of the water, sound waves are transmitted through the water directly to the hydrophone—or by reflections off underwater concrete surfaces. After picking up these sound waves, the hydrophone, operating on a crystal-circuit principle, transmits a signal through an underground cable to the amplifier-relay (located in the alarm panel at the house). At this point the signal is amplified, permitting the relay to close the circuits for the warning devices. The alarm-panel buzzer and external bell will sound until manually reset.

Installation of the pool alarm system is simple, and construction details are shown in Fig. 1. Prior to pouring the concrete walls of the pool, a corrosion-resistant 4-in. by 4-in. box for the hydrophone is placed in the concrete forms of one wall. For optimum results, the box is located between 1 and 2 ft below the designated water level. From the rear of the flush box, a 1/2-in. metal conduit extends upward



**FIG. 2**—Sketch shows well-planned wiring systems for a modern swimming pool, which provides around-the-clock safety for pool owners and bathers. Proper installation of equipment and wiring reduces the possibility of shock hazard. Note that all line-voltage equipment is kept well away from the pool.



**UNDERWATER HYDROPHONE** lead-in conductors are spliced to a RG-174 U coaxial cable in a surface deck box. Coaxial cable runs through an underground conduit to the house alarm panel. A 12-volt, 300-watt pool light with attached cord rests on the ledge of the pool.



**POOL ALARM PANEL** is mounted inside the residence by electrician for Art Levene Electric Co. The fully transistorized unit connects to a 120-volt supply but reduces potential to 3 millivolts for the circuit that extends to underwater hydrophone.

to a flush deck box near the edge of the pool. A  $\frac{1}{2}$ -in. conduit then extends underground from the deck box to the house alarm panel.

After the completion of concrete work, the hydrophone and cable are installed. About 2 in. in diameter, the round hydrophone is completely sealed and comes with a factory-attached, shielded lead-in wire. This lead-in wire is fished into the  $\frac{1}{2}$ -in. conduit from the pool wall box to the surface deck box, and the hydrophone is left suspended in the wall box. For protection of the hydrophone a perforated flush cover is attached to the wall box.

To complete the wiring for the hydrophone circuit an RG-174 U coaxial cable (about the diameter of a No. 14 TW wire) is pulled in the underground conduit extending to the house. Cable splices are then made in the deck box.

At the house the alarm panel is connected to the 120-volt supply and the coaxial cable and external bell circuit are secured to proper terminals (see detail B of Fig. 1).

After the pool has been filled, final tests and sensitivity adjustments are made.

### General Wiring

Fig. 2 shows a plot plan view of the general wiring system used in connection with the pool. A 115/230-volt underground feeder, con-

sisting of four No. 6 UF single-conductor cables, extends from a 60-amp feeder switch to a raintight CB panelboard, located about 12 ft from one end of the pool. One of the UF cables serves as an equipment ground, bonding the panel to the service grounding wire.

Installed about 4 ft above the ground the raintight panelboard is so located that it will fit into one wall of a future pool-side cabana.

From the deck boxes for each of the two 12-volt, wet-niche pool lights, two No. 10 TW conductors with a separate No. 12 TW grounding conductor are installed in a  $\frac{1}{2}$ -in. metal conduit, which extends underground to separate 300-volt pool lighting transformers located

at the load-center panelboard.

Approximately 15 ft from the pool a compact concrete housing, with removable panels, contains the filtering equipment and circulating pump. The 230-volt 1-hp circulating pump is controlled by a time clock, which provides an operating cycle of 3 hours on and 3 hours off. The electrical contractor provided a 3-pole grounding-type receptacle for the pump motor so that the unit can be easily removed for service. And the integrity of the grounding circuit is assured when the motor is reconnected.

For heating the pool, a gas-fired boiler is installed adjacent to the filter housing. No external electrical connections are necessary because a thermal converter provides electricity for controls.

By the use of semi-rigid PVC pipe for the flow and return water lines, no metallic connection exists between the pool and filter-pump assembly. This prevents a low-resistance path to the pool should a ground fault occur in the pump or associated wiring at the same time the circuit grounding conductor is disconnected or a ground connection impaired.

As a protection for circuit splices and ground connections, and to prevent water from collecting inside, all deck boxes near the edge of the pool are filled with non-hardening plastic putty prior to installing the flush covers.



**CONCRETE HOUSING** for filter and circulating pump equipment has removable sides for easy access. Time clock controls 230-volt 1-hp pump motor. Gas-fired hot-water boiler, shown at left, contains a thermal converter, which provides electric energy to operate integral controls.



**MOTOR ROOM** for the 40-in. blooming mill is under positive pressure which helps keep electrical equipment free of dust and contamination. Along left wall are 250-volt dc panels, mill control panels and a 480-volt motor control center. In the center of the photo, one of the twin 3000-hp, 700-volt dc main drive motors is visible. A portion of the 6.9-kv switchgear and the main m-g set, which consists of two 2500-kw, 700-volt dc generators, a 155,000 hp/sec flywheel, and a 4500-hp, 6600-volt wound-rotor motor, can be seen at the right.

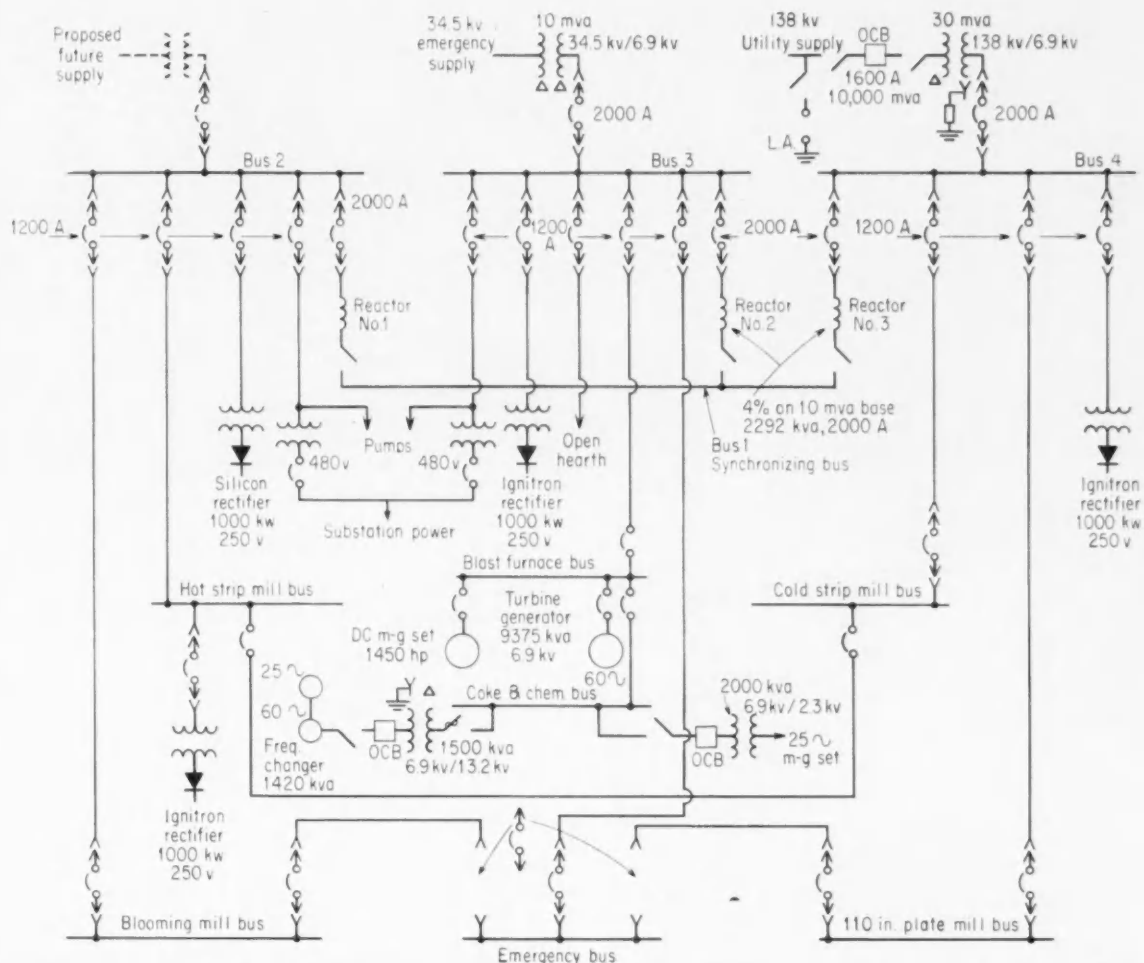
*Design, construction and equipment details for . . .*

## **Steel Plant Electrical Modernization**

Spotlighting a host of cable and conduit installation techniques, a completely revamped 39,000-kva power distribution system required 150 miles of wire and cable plus 60 miles of conduit. Two new rolling mills, a major part of the 36-million modernization program, feature giant m-g sets equipped with driving units ranging in size to 11,000 hp, and huge dc mill motors, automatically controlled by solid-state devices. Also, a modern 1000-kw silicon rectifier successfully operates in parallel with ignitrons to supply high-capacity dc power.

**By Robert J. Lawrie**





**MODERNIZED POWER DISTRIBUTION** involved a drastic recircuiting of the 6.9 kv primary system. Note that the 39,000-kva system has three independent sources of power,

a 138-kv normal incoming line, a 9375-kva turbine generator, and a 34.5-kv emergency incoming line. For additional reliability, essential loads can be fed through tie lines.

**R**EFLECTING a very carefully planned approach, the recently completed electrical modernization at the Alan Wood Steel Co., Conshohocken, Pa., affords a concrete illustration of how up-dating plant facilities results in over-all economics and advantages. For example, in order to design an effective power distribution system that would complement new production lines, meet increased production demands and adapt to later changes or additions, engineers thoroughly studied all aspects of the modernization project. In addition, selection of the best-suited equipment as well as construction methods received equally careful attention.

During these electrical system studies, special emphasis was placed on safety, reliability, operational flexibility as well as simplicity, maintenance and future expan-

sion. Also analyzed were process and production requirements, system power factor, power-demand and fault-duty requirements, and electric power costs.

As a result, the new electrical system provides the key to increased production capacity, higher processing speeds, and better product quality.

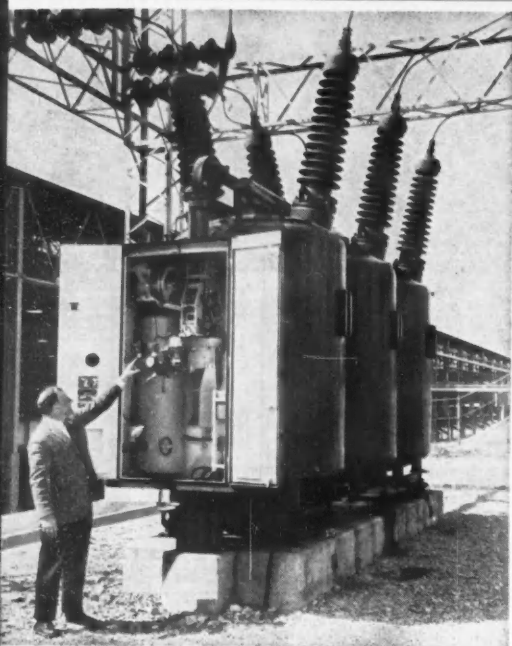
Major construction included the redesigned power distribution system, a new 138-kv outdoor substation, a relocated 34.5-kv emergency outdoor substation, and two modern rolling mills, which are located in a new 175,000 sq ft building.

A multi-building, integrated steel company, Alan Wood has an annual production capacity of 900,000 tons of steel ingots. Products include hot-and cold-rolled sheet, strip and floor plate; chemical derivatives and iron-powder.

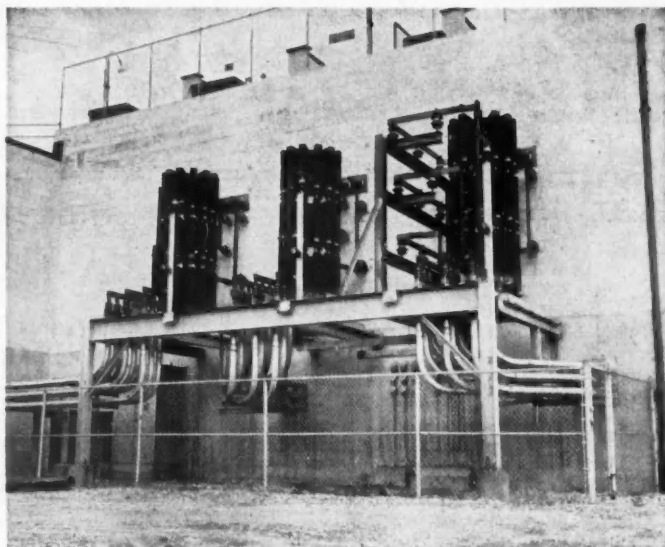
### Primary Power Distribution

A modified primary-selective system replaces the old 29,000-kva radial power-distribution system. The above sketch shows the basic circuitry of the 39,000-kva primary system after modernization.

Philadelphia Electric supplies 138 kv to a centrally located outdoor substation. A 30,000-kva, delta-wye, oil-filled transformer, protected by a 10,000-mva 1600-amp oil circuit breaker, steps down the utility voltage to 6.9 kv for primary distribution. From the substation transformer, the 6.9-kv power extends underground to a distribution substation building nearby. Here, protected by draw-out air circuit breakers, three main buses, plus a synchronizing bus, supply main feeders which fan out to various parts of the plant. Circuitry is such



**OIL CIRCUIT BREAKER** is rated 138 kv, 1600 amps, 10,000 mva. Pointing at operating mechanism is H. W. Vannaman, assistant superintendent of utilities.



**CURRENT-LIMITING REACTORS** will reduce short-circuit currents should a fault occur. Located at the rear of the substation building, which is adjacent to the outdoor substation, the reactors connect the three main 6.9-kv buses with the synchronizing bus.

that in case of a main feeder failure, an alternate primary power feeder can be selected.

From the main switchgear, 6.9-kv feeders extend underground in an electrical tunnel to supply the blooming-mill and plate-mill motor rooms. Here, the primary feeders enter their respective 6.9-kv distribution switchgear where primary branch circuits, protected by draw-out air circuit breakers, emanate underfloor to various large loads. Major loads include the large mill m-g sets, synchronous motors, and a 4000-kva, 6.9 kv/480/277-volt unit substation in the plate-mill motor room and a similar substation, rated 2000 kva, in the blooming-mill motor room. Also, tie circuits connect to an emergency bus installed in metalclad switchgear and equipped with draw-out breakers. Supplied by a separate feeder from the substation, the emergency bus is equipped with a dummy breaker, which can be arranged to feed emergency power to either the blooming mill or plate mill.

In addition, a separate 34.5-kv incoming line supplies the original outdoor substation, which was relocated adjacent to the new substation. This substation, equipped with a transformer bank rated 10,000 kva, will serve as an emergency power source should the main 138-kv source fail.

Supplying additional power, a 9375-kva turbine generator, located

in the blast furnace powerhouse, operates in parallel with the 6.9-kv system. Because it is driven by process steam, it is a highly reliable power source and may be used to supply power to essential equipment if utility power should fail.

Short-circuit studies showed that fault currents available could be extremely high. To limit these currents and to allow use of economically priced protective devices, three dry-type line reactors each rated 2292 kva, 2000 amps, 15 kv were installed. These open-type, 3-phase reactors are located in a fenced-in area adjacent to the main substation and are protected from the elements by a weather-resistant coating. Reactance ratings are 4% calculated on a 10-mva base.

In the blast furnace powerhouse, a 2300-volt turbine generator supplies 25-cycle power for older equipment. Additional 25-cycle power may be generated by a 1420-kva, 13.2-kv m-g frequency changer, which is part of the original equipment. The 13.2-kv driving motor voltage is derived from a 1500-kva transformer, which steps up the 6.9-kv primary supply to required 13.2 kv.

In the main substation building, engineers can operate and monitor the 60-cycle system, which supplies the major share of the power requirements, and a portion of the extensive 250-volt dc distribution system. Stationed at a panelboard, a supervisor controls outdoor sub-

station equipment, main-feeder circuit breakers and certain remote equipment. On the panel, voltmeters, ammeters and remote control switches are arranged in a "mimic" one-line diagram of the various systems. In addition, an annunciator panel provides warning of possible trouble.

Wall-mounted, a one-line diagram status board provides immediate information concerning position of circuit breakers, system tie connections or status of other system components. Constructed of fiber peg-board, this panel utilizes plastic tapes of different colors to represent various systems or voltages. Providing easy assessment of changing situations, small wooden plugs, which are variously color-coded to represent "open" or "closed" breakers, etc., can be inserted into the boards as required.

#### **Cable and Conduit Installation**

The recirculated power distribution as well as wiring for the new rolling mills required a number of different cable and conduit installation techniques. As an example, underground installations included fiber, aluminum and rigid steel conduit run in concrete envelopes. Also, to facilitate underground installation of primary distribution feeders, dc system feeders and control wiring, an electrical tunnel extends from the substation to the rolling mills.

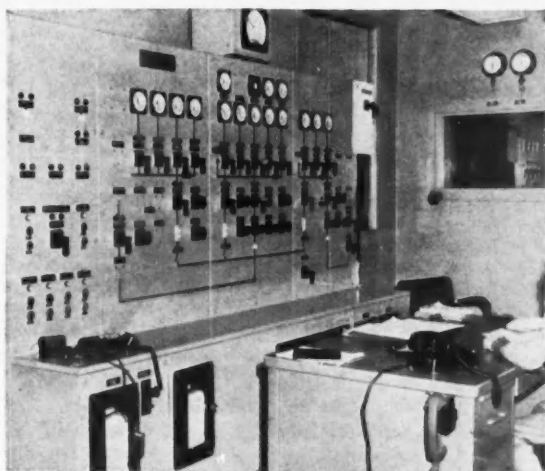
For interior wiring, techniques used include extensive application of aluminum and steel cable tray. Tray sizes vary from 9 in. to 24 in. in width. In the blooming-mill motor room, a 4-tier bank of 24-in. wide aluminum cable tray is mounted along one wall. These trays are bolted to steel angle, which is welded to the building steel. Cable trays were selected primarily to carry the miles of control wiring as well as certain 480-volt conductors.

Other installation methods selected include rigid metal conduit run underfloor and exposed; open wiring supported by insulating

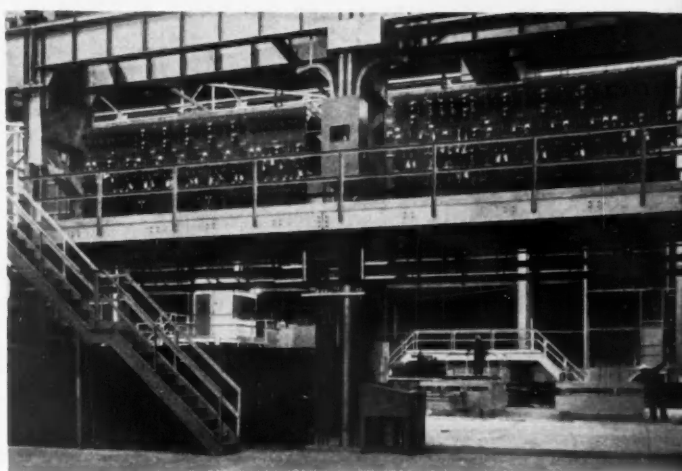
spools, or with cables mounted in a cleat and ladder method; and 15-kv interlocked armored cable suspended from messenger wire.

An excellent example of the various methods utilized is the 6.9-kv main feeders for the blooming-mill and plate-mill equipment. Consisting of 500 MCM, 15-kv interlocked armored cable, two per phase, blooming-mill and plate-mill main feeders extend from the substation switchgear underground in an electrical tunnel to a manhole in the plate-mill motor room. The tunnel, 8 ft in dia., is equipped with cable trays, which carry the primary feeders as well as other conductors.

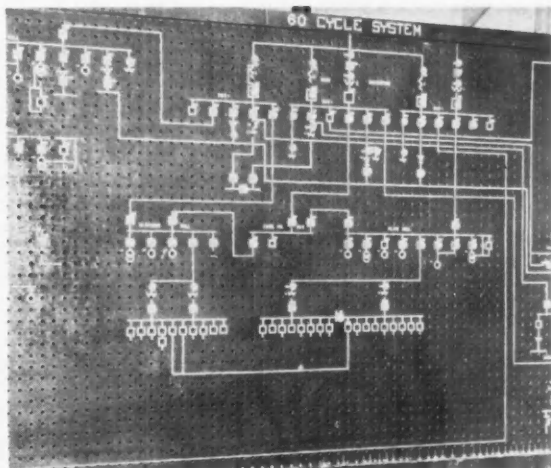
From the manhole, the plate-mill feeders enter nearby 6.9-kva switchgear, the blooming-mill feeders extend up the wall of the motor room on a cable ladder and continue overhead and across the motor room and into the mill area in a 20-in. wide aluminum cable tray. In the mill area, these six single-conductor, 15-kv interlocked armored cables, are suspended individually on  $\frac{1}{4}$ -in. steel messenger wire. Mounted in the roof trusses about 60 ft above the floor, these messenger cables extend about 625 ft to a point opposite the blooming-mill 6.9-kv switchgear. Here, the cable is transferred to 20-in.



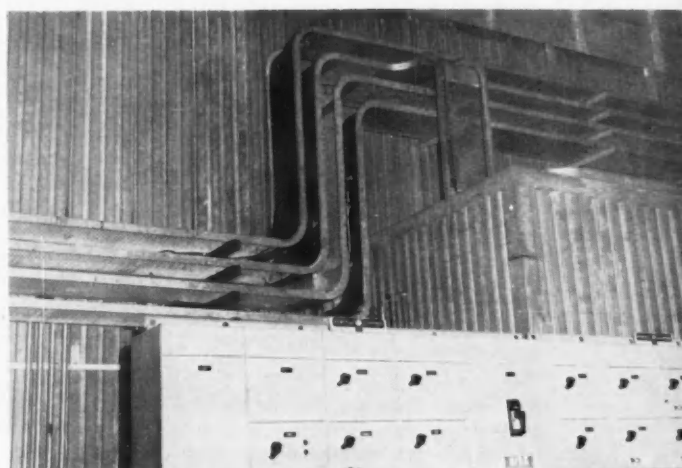
**PRIMARY SYSTEM CONTROL PANEL** allows supervisors to monitor and remotely operate circuit breakers. Panel at left provides control of the paralleled silicon rectifier and ignition rectifier. Ammeters, voltmeters, recorders, indicating lights and an annunciator system are installed on panel.



**SEQUENTIAL CONTROL SYSTEM** automatically supervises movement of rolled plate from leveling, cooling and shearing areas into the shipping department. Installed between two line-ups of bridge-mounted controllers, a 2000-amp load-break switch provides safe disconnecting means.

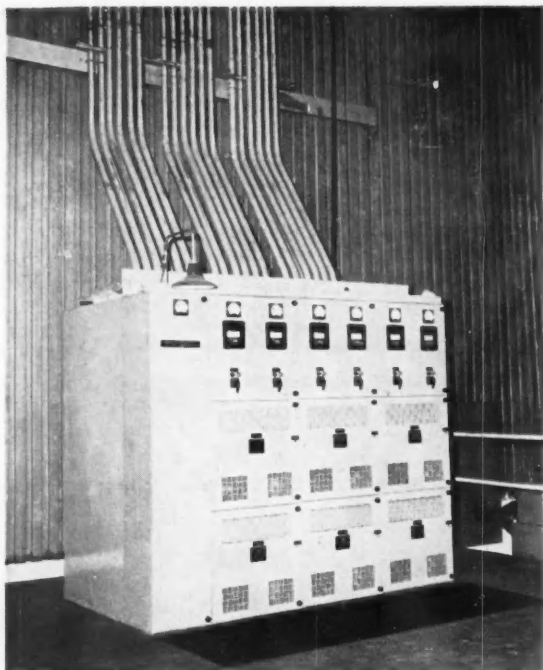


**STATUS BOARD** presents a one-line diagram of the primary distribution system and provides immediate information concerning status of system components. Small wooden plugs, which are color coded to represent "open" or "closed" breakers, are inserted into the peg-board as required.

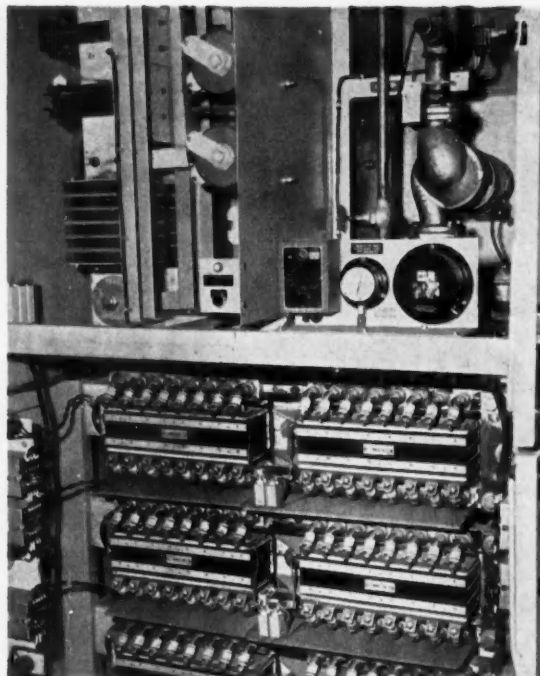


**FOUR-TIER BANK** of 24-in. wide cable tray carries multi-conductor control cable and single-conductor, 480-volt branch-circuit conductors in the blooming-mill motor room. Aluminum trays are bolted to steel angle which is welded to building steel.





**PLATE-MILL DC SWITCHGEAR** receives 250-volt dc power underfloor via 1000 MCM conductors, seven per leg. These feeder conductors are protected by a 6000-amp circuit breaker at the powerhouse. Rigid metal conduit rising above the switchgear carries dc conductors up to roof trusses where the distribution system converts to open wiring.



**SILICON RECTIFIER**, rated 1000 kw, 4000 amps at 250 volts, operates in parallel with mercury arc rectifiers. Banks of paralleled silicon diodes are shown mounted on water-cooled busbars. Current-limiting fuses are connected in series with each diode. Special protective circuitry is in section at top left; cooling water controls are at top right.

wide tray, which extends to a point above the switchgear. Then the cable drops down to the switchgear on cable ladder.

Much of the 480-volt system is installed as open wiring being mounted on insulators in the roof trusses. However, all risers from the floor-mounted equipment to the overhead lines are run in conduit. In the 250-volt dc system, 750 MCM and 1000 MCM single-conductor feeders, up to seven per leg, are installed as open wiring on insulators, in cleats supported by aluminum ladder, or are carried in conduit and cable tray.

### **Silicon Rectifier**

Typifying the progressive techniques applied in this electrical modernization was the installation of a modern silicon rectifier rated 1000 kw, 4000 amps at 250 volts dc. Connected in parallel with three 1000-kw ignitron mercury arc rectifiers, the new semiconductor unit replaces an old 25-cycle motor-generator set, which previously supplied a portion of the plant's 250-volt, constant-voltage, 4000-kw dc loop.

The silicon unit is installed adjacent to a 1000-kw mercury-arc rectifier in the substation building. Both rectifiers along with their auxiliary equipment, circuit breakers and transformers form an integral dc substation. The rectifier transformers step down 6.9 kv to about 300 volts at each rectifier unit. At the transformer primaries, main air circuit breakers, each rated 1200 amps, 500 mva, provide overload and short-circuit protection.

Providing additional short-circuit and overcurrent protection, a specially designed, high-speed protective device will remove fault currents from the rectifier in approximately one-tenth of a cycle. When a fault occurs, a high-capacity switch shorts out the rectifier shunting fault currents away from the rectifier. This also places a deliberate short circuit on the transformer secondary causing the transformer primary ac breaker to open in less than 8 cycles. In addition to providing high-speed protection, the use of a circuit closing switch eliminates arcing and transient voltage problems.

The silicon rectifier's protective

scheme distinguishes between arc-backs, which occur occasionally in mercury arc rectifiers, and bus or feeder faults. To assure continuity of service, the silicon unit rides through an arc-back and picks up essential power load dropped by the mercury arc unit when arc-back occurs. To effect this operation, special reactor circuitry and a high-speed breaker limit the current and rapidly open the circuit at the mercury arc unit when arc-back occurs.

Further protection for the silicon rectifier is provided for by individual current-limiting fuses connected in series with the silicon cells. There are 192 separate cells with two cells and a fuse connected in series to form 96 parallel circuits.

To insure proper current division between parallel circuits, a balancing voltage is applied to each cell forcing equal current distribution. In addition, a resistor-capacitor network suppresses switching or other transient voltage surges.

Main advantages gained by the installation of the silicon rectifier, include higher efficiency resulting in lower operating costs, higher reliability, rapid and economical



installation and savings in floor space.

### Rolling-Mill Electrical Equipment

The heart of the modernization program was the installation of the two new rolling mills, the 40-in. blooming mill and the 110-in. plate mill. At the blooming mill, steel ingots are heated, rolled into slabs and sheared to length. At the 110-in. plate mill, mammoth reversing rolls and a non-reversing mill stand convert the slabs into wide steel plate.

Electrical equipment for both mills is installed in two motor rooms, which are adjacent to their respective mill areas.

Major equipment for the blooming mill includes two 3000-hp 40/80 rpm, 700-volt dc motors, which power the reversing mill stand. Supplying dc power for these mill motors is a 5-bearing, 514 rpm motor-generator set, which consists of two 2500-kw, 700-volt dc generators, a 155,000-hp sec stored-energy flywheel, and a 4500-hp, 6600-volt wound-rotor driving motor. A liquid rheostat, coupled with amplidyne control, provides load-torque regulation for the wound-rotor motor.

Two m-g sets, each consisting of a 1000-hp, 6.9-kv synchronous motor and multiple, tandem-mounted dc generators, provide power for auxiliary dc loads.

Other major equipment includes the 6.9-kv switchgear which incorporates the large motor starters, and branch and tie circuit breakers. To provide utilization voltages, a 2000-kva, 6900/480/277-volt unit substation is installed. This substation is equipped with paralleled 1000-kva transformers, each protected by a 1600-amp secondary circuit breaker; primary load-break switches; and enclosed secondary bus, which feeds metalclad draw-out switchgear.

Control panels include the master mill panel, which affords automatic mill-motor speed regulation and monitors the blooming-mill equipment through an annunciator system; 250-volt dc line panels; auxiliary variable-voltage control; and motor control centers, which supply 480-volt equipment.

Electronics play a major role in this installation because static logic circuitry (transistor circuits) are used extensively in the mill control system. The primary function of

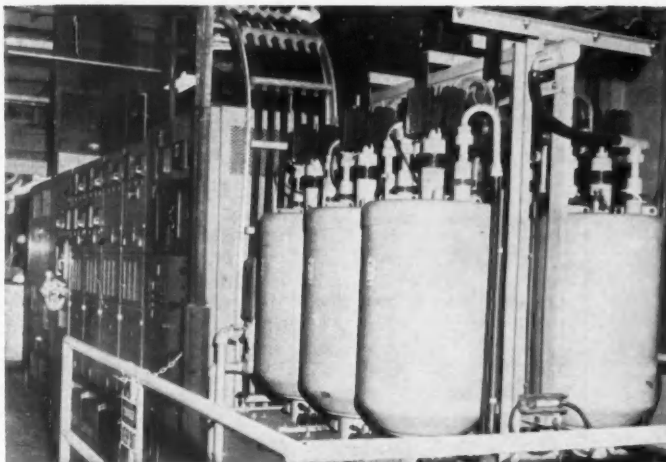
these transistors is to perform switching sequences formerly accomplished by relays. In addition, the static devices provide for simple modification when future programmed control is installed.

Equipment for the 110-in. plate mill is similar except that here the twin reversing mill motors are rated 4000-hp, 700-volts dc, 40/80 rpm. These motors draw power from a motor-generator set composed of two 3500-kw and one 1250-kw, 700-volt dc generators driven by an 11,000-hp, 6600-volt, 360-rpm synchronous motor. The 1250-kw generator supplies 700-volt dc

power to two 750-hp motors, which power a vertical edger at the reversing mill. In addition, a non-reversing stand, which makes a finishing pass on the steel plate, is powered by a 5000-hp, 6600-volt synchronous motor.

Control of the reversing mill is also accomplished through static logic circuitry incorporating NOR logic, and solid-state timers and amplifiers.

Consulting engineers for the project were United Engineers and Constructors Inc., Philadelphia, Pa. W. V. Pangborne & Co., Inc. were the electrical contractors.



**SEALED TUBE IGNITRON** mercury arc rectifier and paralleled silicon rectifier (at far end of the switchgear) along with metalclad circuit breakers form an integral dc substation. Note cleat and ladder assembly supporting single-conductor, neoprene-jacketed cables.



**PLATE-MILL MOTOR ROOM** equipment includes 6.9-kv switchgear and double-ended, 4000-kva, 6.9 kv/480-volt unit substation along right wall. On left are mill control panels, which incorporate solid-state devices for logic sequence. Auxiliary m-g sets are in center aisle with the main drive 11,000-hp m-g set located at the end of the aisle. In the center of the photo, and partially obscured by the main m-g set, are the dual 4000-hp, 700-volt dc main drive motors.

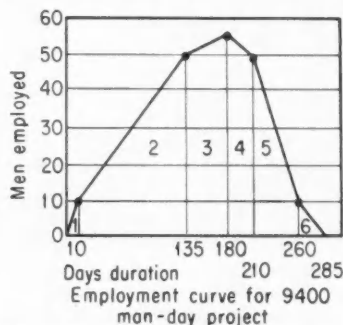
# Analyzing Reported Costs Of Proposed Projects

## PART III—Manpower Requirements

By Ray Ashley, Research and Consulting Engineer, Oak Park, Ill.

### CONSTRUCTION PERIODS FOR ECONOMIC OPERATION OF ELECTRICAL INSTALLATIONS—INDUSTRIAL SEE NOTES BELOW

LABOR		CONSTRN PERIODS—SEE SKETCH BEL.									TOTAL PERIOD		AVNO OF MEN EMPL.
MAN HOURS	MAN DAYS	1 8 6			2 8 5			4 8 3			DAYS	WKS.	
		DAYS	MEN AV	MAN DAYS	DAYS	MEN AV	MAN DAYS	DAYS	MEN AV	MAN DAYS			
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1,250	156	10	2	20	12	4	48	15	6	90	37	7.4	4.2
3,150	394	12	2	24	35	6	210	16	10	160	63	12.5	6.3
6,400	800	12	2	24	52	8	416	30	12	360	94	19.	8.5
13,600	1700	15	4	60	75	12	900	37	20	740	127	25.4	13.4
28,000	3,500	20	4	80	125	16	2,000	60	24	1,440	205	41	17.1
44,000	5,500	30	5	150	145	22	3,190	60	36	2,160	235	47	23.4
59,500	7,440	30	5	150	160	26	4,160	70	45	3,150	265	53	28.5
75,000	9,375	35	5	175	175	30	5,250	75	53	3,975	285	57	33.
90,000	11,250	40	5	200	185	34	6,290	80	60	4,800	305	61	37.
112,500	14,060	42	7	294	225	37	8,325	85	64	5,440	350	70	40.
150,000	18,750	45	11	495	270	45	12,150	85	72	6,120	400	80	47.
190,000	23,750	50	14	700	295	54	15,930	90	80	7,200	435	87	54.5
230,000	28,750	60	15	900	300	66	19,800	90	90	8,100	450	90	64.
267,000	33,375	65	16	1,040	304	72	21,888	95	110	10,450	465	93	72.
305,000	38,125	70	18	1,260	310	79	24,490	100	125	12,500	480	96	80



Estimated optimum duration for  
a job requiring 9400 man-days

Period	Days	No. of men-av.	Man days
1	10	5.	50
2	125	30	3750.
3	45	53	2385.
4	30	53.	1590.
5	50	30	1500.
6	25	5	125.
Totals	285		9400

- 1.—Periods based on progress free of interference from other operations.
- 2.—Contractor must be manned, equipped and organized to expeditiously carry on the work.

Source: Electrical Contracting, McGraw Hill Book Co.

## STATEMENT:

In this series of articles about analyzing reported costs, we now come to the subject of manpower requirements (MPR). To establish these requirements, one must know the estimated job hours of labor, the nature of the project, and the approximate duration.

Knowing the MPR and duration enables the electrical contractor to see how the project will fit his existing work program and how the financing will be distributed.

To provide an example for this portion of the

analysis, we shall continue with the 10-story office building project used in the previous article. At that time, the following basic project data were established:

Base Cost (purchase price of material and payroll) .....	\$480,000
Base Cost of Material .....	\$288,000
Base Cost of Labor .....	\$192,000
Man-Hours Job Labor .....	48,000
Reported Cost of Complete Electrical Installation .....	\$600,000

## QUESTIONS:

*Knowing these previously established facts:*

1. *What will be the approximate duration of the project?*
2. *What will be the (a) average and (b) maximum manpower requirements?*
3. *How many man-hours will be required for estimating?*

## ANSWERS:

1. *Duration of the project will be approximately 52 weeks.*
2. *Manpower requirements will average 26 men with a maximum of 36 men at peak periods.*
3. *This project will require 264 man-hours of estimating time.*

## DISCUSSION:

The table in Fig. 1 is a study of construction periods, manpower requirements and project duration for economic operation of electrical installations. While the values are for optimum duration, they can be used for the problem we are considering. A 10-story office building with typical floors affords a good work program and our answers will be approximations.

The project under study has an estimated 48,000 hours of job labor. The nearest listing in Fig. 1 is for 44,000 hours (Col. 1). Although job requirements do not vary in exact proportion to the labor hours, for the difference represented here we can assume that they do. Our 48,000-hour figure is slightly over 9% greater than the 44,000 figure in the Table. In our example we shall use 10% as one would do in actual practice.

### Project Duration

An optimum duration of 47 weeks is shown in Fig. 1, Col. 13, for a project requiring 44,000 man-hours of labor. Adding 10% to approximate the 48,000-hour figure for our example, we get 51.7 weeks. We shall use 52 weeks as the estimated duration of our project.

In actual practice, one would use the 52 weeks as a standard and alter it, as he saw fit, to suit anticipated

working conditions. The general contractor, the weather, cooperation of other trades, and material deliveries all are major factors that can affect job duration.

### Manpower Demands

Col. 14 of the Table in Fig. 1 gives the average manpower requirements (MPR) for various size projects (total man-hours). Average number of men needed for various construction periods comprising the employment curve are shown in Cols. 4, 7, and 10.

For the 44,000 man-hour project, Col. 14 shows 23.4 as the average number of mechanics needed for the completed job. Our project has a 48,000 man-hour total, so we add 10% and come up with 25.7-man average. We will use 26 as the average number of men required.

Maximum MPR on a well managed job will run about 35% to 40% greater than the average manpower requirements. We shall add 40% to our 26 (average demand) and get 36.4. Thus, the maximum number of men required during peak construction periods will be 36.

As noted before, this is basically a case of using the estimated manpower figures as standards to be raised or lowered according to anticipated factors which will affect construction progress.

### Estimating Time

In a previous study of allocation of estimating time (Estimating Forum—XXI, pg. 102, June, 1962, El C&M), the following values of estimating time per 100 hours of job labor were developed:

Annual Volume of	
\$800,000 .....	2.38 hours
Large Projects .....	0.70 hours
Alterations	
(Average, large and small) .....	4.42 hours
Exceptionally Favorable Projects .....	0.28 hours

The Walter Brand Study, presented in the same article, gave 0.56 hours of estimating time per 100 hours of job labor as average for two 10-story office buildings.

Consideration of these, and other previous studies, indicates that a figure of 0.55 hours estimating time per 100 hours job labor is a suitable unit for the 10-story office building in our example.

Our example has a total of 48,000 man-hours of job labor. Estimating time is calculated as follows:

$$\begin{array}{r} \text{Estimating Time} = \\ 48,000 \\ \hline 100 \end{array}$$

$$\times 0.55 = 264 \text{ hours}$$

Analyzing reported costs of proposed projects has been the subject of the last three discussions.



**STEP 1**—Trencher cuts continuous 6-in. slot-trench, about 36 in. deep, behind existing highway lighting standards. Short laterals to pole base are dug by hand.



**STEP 2**—Prewired duct installation. Mechanic on slowly moving truck unreels duct-cable while another lays it in trench with slight "snaking" pattern to accommodate expansion and contraction.

*Save Man-Hours with . . .*

## Prewired Direct-Burial

Meade Electric Co., Chicago, replaces damaged direct-burial lighting circuits on Edens Expressway with new preassembled duct-cable system. Limited experience shows promise of man-hour economies on installation and particularly circuit maintenance.

**By August Eckel**

**D**IRECT-BURIAL cable circuits feed some 1100 mercury-vapor street lights along the 14-mile length of Edens Expressway—a six-lane, 60-mph, concrete superhighway skirting Chicago's north side and suburban residential areas (El C&M, May 1953, pg. 92). For years, the Illinois Department of Highways and Meade Electric Co., who maintains its superhighway lighting and traffic control systems, were plagued with intermittent circuit outages.

These occurred at points where the cables entered the prestressed concrete standards and at various locations between poles where sharp stones and objects filtered through the trench backfill to damage conductor insulation. Time, frost-heave, highway traffic vibration, heavy trucks parked on shoulders, and directional sign placement were listed as contributing factors. Up until the present, the economic solution was the time-consuming process of locating the fault, dig-

ging up the damaged cable, making a splice (or even replacing cable sections) and burying it again.

Recent development of a preassembled duct-cable system may alter the accepted concept of direct-burial underground distribution. The unit assembly comes from the factory on reels, can be laid in a slot-trench and backfilled immediately with the excavated earth. The high-strength, coilable plastic duct provides an unusual degree of permanent mechanical protection to the





**STEP 3**—Trench backfilling is accomplished with "dozer" attachment on jeep trencher. No sand bed and cover, or screening of backfill is necessary. Plastic duct protects conductors from mechanical damage.

conductors it encloses; permits those conductors to be removed and replaced (even with a larger size) if necessary. This feature aroused the interest of Illinois Highway Department electrical engineers who foresee a sharp reduction in circuit maintenance where the duct-cable system is used. Consequently, Meade was instructed to replace damaged underground circuits on Edens with the new duct-cable assembly on a test basis.

### 3-Step Installation

Meade's initial experience with the new material was gained on two installations. The first was a replacement section involving 1000 ft of 1½-in. plastic duct enclosing two No. 6 THW polyvinyl-chloride insulated conductors and one No. 6 bare conductor. The second section required 1100 ft of 1½-in. duct enclosing two No. 2 insulated and one No. 2 bare conductors. The unit assembly duct is a high-density polyethylene plastic with 0.106 wall thickness and sufficiently flexible to be coiled on a 60-in. reel.

In both cases a simple 3-step installation procedure was used.

First, a jeep trencher dug a continuous 6-in. slot-trench, 36-in. deep, immediately behind the concrete standards. Access openings

## Plastic Duct



**DUCT-CABLE** is cut with hacksaw at pole locations. Note fish-rope in handhole to pull conductors and duct up into pole from underground slot in base.



**CONDUCTORS** in flexible duct meet NEC fill limits; can be easily removed or replaced. About 8 in. to 12 in. of duct are removed for pole splices.



**AT POLE BASE** prewired ducts enter and leave butt slot for handhole splices. Ducts are pushed up to the bottom of hand-hole enclosing taped splices.



**THE OLD METHOD.** Partially uncovered butt slot shows direct-burial cables entering pole base. Frost-heave and vibration often damaged conductors at this point.

were dug at each pole to uncover entrance slots and provide a sweep for the duct-cable. The original direct-burial circuits were not disturbed; merely cut off at the pole base.

Next, as a reel truck moved slowly along the highway shoulder, the duct-cable was played-out and laid in the trench with moderate snaking to accommodate contraction and expansion. At pole locations, the assembly was cut and an 8-in. to 12-in. section of duct removed for splicing. Cable and duct were then fished and pushed into the access slot in the pole base. Duct ends terminated at the bottom of the splicing handhole.

Finally, as the pole connections were being made, the jeep trencher with a front-mounted "dozer-blade" backfilled the trench. Tamping, as required, followed.

#### **Where Man-Hours Are Cut**

From an installation viewpoint, the biggest advantage of the duct-cable system is that a raceway and its conductors are installed

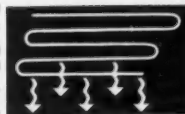
simultaneously and with an ease approaching that of direct-burial cable alone. Compared with conventional underground duct installations, with their wider trenches, duct cutting and coupling, and cable pulling, the man-hour economies are quite obvious.

Even comparison with direct-burial cable installations reveals man-hour economies in favor of the prewired duct system. While the reels and duct-cable assembly are a bit more difficult to handle, there are these "plus" factors: No sand bed is needed in the bottom of the trench; no sand cover is needed over the duct-cable; no screening and hand shoveling of initial backfill is necessary. Each has its own quota of man-hours which the new system saves.

However, this should not imply that the duct-cable *installation-cost* to the contractor is less than the direct-burial cable method. Obviously, the material cost of the duct-cable assembly is greater than that of a comparable number of direct-burial cables. This differential is

offset by the installation man-hour economies. Based on limited experience to date, Meade engineers report that, dollar-wise, the installation cost of the two systems are about the same. As more of the new system is used, more installation experience is gained, and where improved techniques are evolved, this picture may change so that the duct-cable system could be the least expensive method.

Biggest man-hour savings are expected to accrue in lighting circuit maintenance. The integral plastic raceway of the new system should prevent mechanical damage to the conductors and eliminate many of the troublesome circuit outages experienced in the past. If necessary, conductors can be quickly removed and replaced without the expensive probing, digging and splicing operations previously required. On the basis of such anticipated reduction in lighting maintenance costs, the duct-cable system has recently been approved for a new expressway now under construction in the Chicago area.



# Heating with Infrared

A detailed look at infrared comfort heating, including sources, fixtures, physiological factors, capacity requirements, methods of control, and markets. Second of two parts.\*

**F**IG. 2 illustrates and describes some basics of fixture placement and radiation patterns which will aid in making decisions as to required capacity. Using these relationships, the area of radiation on the floor or on any plane between the fixture and the floor may be found. Given the angle of concentrated uniform radiation provided by the fixture design, the width  $W$  for any given mounting height  $H$  is easily determined by simple trigonometry or by a scale drawing on cross-section paper. The fixture length is known; therefore  $L$  and thus the area of radiation on the floor can be calculated. Radiation on other planes may be determined similarly, using different values of  $H$ . Results of such calculations are shown in Fig. 3A for three planes representing the floor, the worker's waist level, and the worker's head level. Note that the figures do not represent radiation received by the floor, etc. How much of the input energy will be absorbed by the floor is unknown, but it can be described in terms of the energy put into the heater. If, for a given heater, we knew that 8.8 watts/sq ft input density on the floor at a 10-ft mounting height would produce comfort, that would be sufficient for design purposes.

In such an installation, maximum radiation would be received directly beneath the heater. The curves to the right show how the radiation intensity would drop off in each of the three planes on each side of the heater as the distance to the radiating element increases. The head, being closest to the heater, would be subject to the greatest variation, while radiation at the level of the feet would vary only slightly.

It is apparent that this does not represent a very satisfactory arrangement. Standing directly beneath the heater would expose a relatively small part of the body's surface area to the heat, while moving to either side would mean losing the benefit of the maximum concentration of radiation.

Fig. 3B shows the same fixture mounted so as to project its beam at a 45-degree angle with the floor. The same three horizontal planes have greatly increased areas, and the maximum watt-densities are

now at the extreme left of the planes. Radiation at the head level drops off rapidly in moving to the right and to a lesser extent at the waist and foot levels. While more of the body will be radiated with the fixture in this position, it is obvious that only one side can be warm at a time.

Adding a second fixture radiating at the same angle but in the opposite direction greatly improves the situation, as shown in Fig. 3C. Only those portions of the areas which are radiated by both fixtures are pictured. With the fixtures spaced so as to focus the center of their beams at the waist level, the density of radiation at waist and foot level is almost uniform throughout the area, only the head radiation varying appreciably as the fixtures are approached.

It is evident that two fixtures are required to do an acceptable job; a third and fourth radiating from the other two directions would be an additional big improvement.

As demonstrated by the illustrations, the total input wattage to the heaters can be described as being distributed over a given area within the radiation patterns of the fixtures at any point between the heaters and the floor. Thus some design recommendations are based on watts/sq ft referred to the radiated area on the floor, others on watts/sq ft referred to the radiated area at waist level. Obviously, the latter will be higher for a given heater since a smaller area is involved.

An adjustment is necessary to account for ambient temperature conditions. One approach is to base watt-density recommendations on the outdoor design temperature, with appropriate modifications according to whether the installation is in an insulated building, an uninsulated building, or outdoors. Another method is to base the design on the actual minimum ambient air temperature expected. It would seem that the latter is more logical, since the ambient air temperature can vary widely in two similar buildings, depending upon the radiation absorbed by surrounding objects such as machinery, the extent to which outside air is permitted to enter, the proximity of the heaters to the outside walls, etc. However, anticipating this temperature for application in a building which does not yet exist at the time of design can be quite a problem. For outdoor applications, extra capacity provided will depend upon the type of element used and the expected wind speed.

\* Adapted from papers presented at NEMA's Second Electric Comfort Heating Exposition & Symposium in Chicago, March, 1962, by R. L. Boyd, Edwin L. Wiegand Co.; W. R. Stephens, General Electric Co.; and W. J. Novak, El C & M.



Radiating efficiencies of all types begin to drop off with the slightest wind. With any significant wind speed, the drop in radiating efficiencies plus the chilling effect of the wind on the body can completely nullify the warming effect of the heater.

A third modification is necessary for differences in mounting height. The fixture design may not adequately concentrate the radiation of the element at mounting heights much greater than 10 ft; hence a safety factor is usually introduced in such cases.

These considerations, coupled with differences in radiation efficiencies of the various available infrared sources, account for the lack of uniformity and certainty in design procedures. Experience will ultimately influence judgment in each individual case. Although new and unique applications of infrared are being installed every day, there are more than enough varied installations in use and publicized to provide a working base which will help in design. Manufacturers, interested in seeing the best performance possible with their product, are doing their best to provide guidance and make refinements in their recommendations as deemed advisable by accumulated experience.<sup>1</sup>

### Control

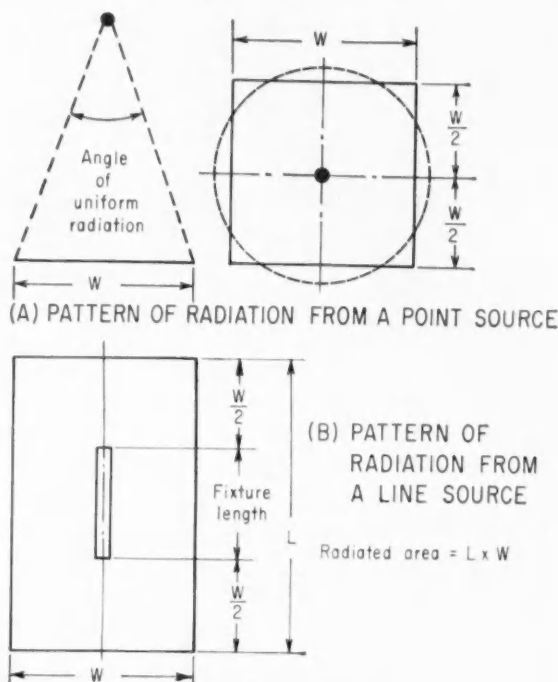
Consistent comfort can be provided only if means are available to vary the heating effect as the heating requirement changes. Practical methods of accomplishing control include manual on-off operation of individual circuits, operation at reduced voltage by manual switching or more costly electronic devices, and automatic on-off operation through a percentage timer (input controller).<sup>2</sup>

Exact intensities produced by voltage reduction will vary with type of element. Theoretically, reducing voltage by 50% should reduce power output by 75%. However, the actual heating effect will be reduced to a greater extent than indicated when a lower voltage is applied due to the change in element resistance at lower operating temperatures. This is especially true of the quartz lamp. The efficiency of the quartz lamp as a lighting source (lumens per watt) also decreases drastically as the applied voltage is reduced; hence the change in lighting level may be objectionable unless controlled supplementary lighting is also provided to make up for the loss. This change in visible output must be kept in mind in the design of any control system for quartz lamps.

Increased control may be obtained through the use of input controllers, or percentage timers. Such devices alternately energize and de-energize the heaters, the "on" time being continuously adjustable from 0-100% by means of a knob and graduated scale. Operation may be controlled by synchronous-motor-driven cams or by a thermal element, furnishing two to three on-off cycles per minute. Increasing the percentage adjustment increases the length of the "on" cycles. Where precise timing is required, the motor-driven type would be preferred, since its operation is not affected by the ambient temperature.

Percentage input controllers are most effective with metal-sheathed elements and quartz tubes. Their dull red visible glow is not distracting when switched on and off. However, the high light output of the quartz lamp may make frequent on-off cycling objectionable.

FIG. 2. Basic Radiation Patterns



(A) The radiated beam from an infrared source of small diameter incorporating a reflector will be essentially conical in shape, producing a circular pattern on a horizontal plane below, such as the floor, when mounted to project its beam vertically. For design purposes, this pattern may be assumed with little error to be a square with side  $W$ .

(B) If this small source is imagined stretched out to form a tubular shape, the square pattern will be increased to a rectangle, and side  $W$  will be increased by the length of the infrared source. The area of the radiation pattern is thus  $L \times W$ , where  $L$  is roughly equal to  $W$  plus the fixture length.

With planned spacing of lamps for large-area heating, one circuit with a percentage timer plus one or more circuits without timers will provide wide flexibility of control through various combinations of energized and de-energized circuits.

For spot-heating applications, an input controller can be installed at each work station for manipulation by the worker. If all work stations are in constant use, more effectiveness of control can usually be achieved using a master unit to control the heaters of several work stations through magnetic contactors, its adjustment being the responsibility of a single designated individual. Experience will show the percentages producing optimum comfort for most workers at various ambient and outdoor air temperatures.

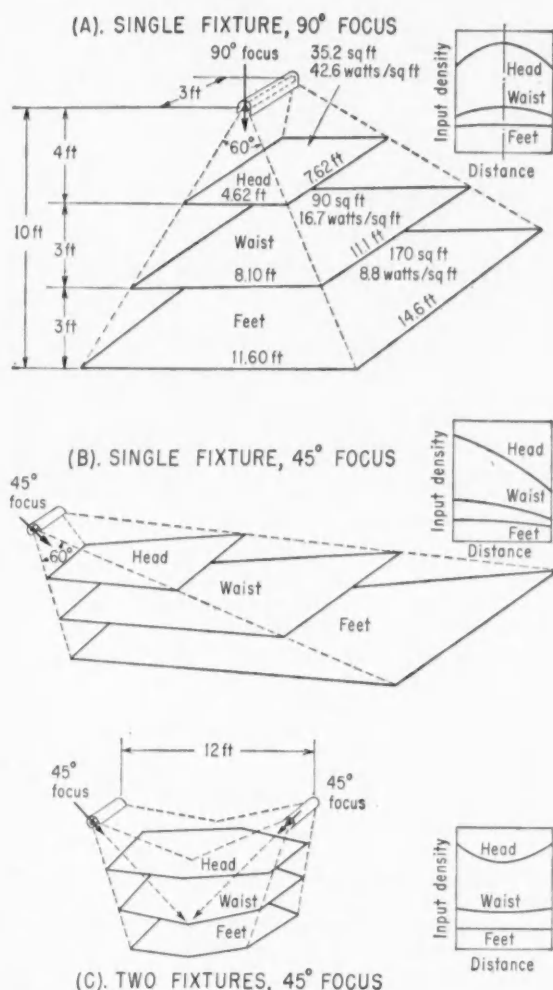
For certain periodically manned work stations, it may be desirable to maintain some minimum heat to avoid freezing or congealing of fluids, etc. In such cases a percentage timer at a low setting may suffice, or it may be used in conjunction with a thermostat.

The thermostat finds its widest infrared application in over-all heating installations where secondary



**FIG. 3. Fixture Mounting**

## Markets



(A) A 3-ft fixture is shown producing a 60-degree concentrated beam from a 10-ft mounting height. Three patterns of radiation are indicated: one on the floor; one 3 ft from the floor, representing the approximate location of a worker's waist; and one 6 ft from the floor, representing the top of the worker's head. Calculations give the dimensions and areas shown. If the fixture is assumed to be rated at 1500 watts, dividing 1500 by each of the three areas in turn gives the "input densities" directly under the lamps, in watts per sq ft. Curves show how radiation drops off on each side of the fixture.

(B) Fixture tilted at 45-degree angle warms greater percentage of body, but only one side at a time.

(C) Two fixtures from two directions provide minimum acceptable comfort. Three or four would be better.

convection can be depended upon to maintain an inside ambient air temperature which, together with re-radiation from surfaces within the heated space, provides comfort conditions during relatively short periods that the heaters may be turned off by action of the thermostat. In all cases, the thermostat must be shielded to prevent its being affected by direct radiation from the heaters.

The market for possible uses of infrared comfort heating are literally as broad as all outdoors (and innumerable otherwise impossible indoor areas). Particularly attractive are spot heating applications where no heat has been customarily furnished in the past because it was economically impractical with usual means. Electric infrared, with effective fixtures to control the patterns of radiation, can put the heat exactly where it is wanted. Electric infrared can be equipped with a high degree of control so that the radiant energy density can be closely matched to the requirements of the moment. Many applications with huge areas (and volumes) and occupied by relatively few workers such as factories, warehouses and lofts can be heated on a spot or selected-area basis, providing comfort without the necessity of warming up the entire space.

Highbay manufacturing areas, where the bulk of the building and uninsulated construction make heating the space impractical, can also be heated by infrared, providing comfort without the expense of materially raising the air temperature.

Snow melting installations with substantial comfort heating benefits are indicated for show windows, building entrances and anywhere a marquee has been constructed.

Bus shelters, drive-in and walk-in banks, food service, and other similar applications in which the customer remains outside the establishment offer fertile fields for development of infrared markets.

Freeze protection for equipment or to keep grease from stiffening excessively in pump houses, automatic bowling alleys and other unheated spaces with automatic rotating equipment, are attractive targets for the infrared salesman.

Outdoor sports areas, grandstands, miniature golf, trampoline courts, driving ranges, and other outdoor activities, can extend their seasons several weeks each end of the normal season by using infrared comfort heaters.

Outdoor living can be extended in the spring and fall through the use of infrared heaters mounted over residential patios; swimming can be more enjoyable on cooler nights with the pool area radiantly heated. Other residential applications where infrared may be used to advantage include garage or basement workshop and laundry areas, bath and shower rooms, covered breezeways, and porches.

Any space can be heated by infrared—but in many cases this would not be the preferred method. Many spaces and areas that really couldn't be heated practically any other way can be effectively and economically heated with infrared. Many situations which cannot be made really comfortable by any practical means can be made more tolerable by proper use of infrared. It is the responsibility of the electric industry to learn to distinguish one case from another—and to learn how to apply infrared comfort heating most advantageously in applicable cases—and to predict accurately and represent factually the results to be expected.

1. For an example of manufacturers' recommendations, see "Infrared Spot Heating," EHF No. 5, Nov., 1960.
2. See "Input Control of Infrared Heaters," EHF No. 7, Jan., 1961.

# Electrical Hazards On Construction Projects

Electricity can be handled and used with the utmost safety. Understanding a few important facts will enable construction gangs in the immediate vicinity of power equipment, welding apparatus, temporary wiring, etc., to protect themselves against exposures to electric shocks.

By Roy Woodworth and Alfred Dowden, *Liberty Mutual Insurance Co.*

**W**HAT can and should be done in order to curtail the growing frequency rate of electric shock accidents and fatalities among employees in industry? The answer is manifold. Education and instruction of "non-electrical" workers and stricter emphasis of caution on the part of sophisticated electrical workers can control most causes of accidents. The use of proper equipment and the practice of safe operating procedures must also be emphasized and observed to further reduce electrical accidents.

The plain fact is that more than 1000 deaths—caused by inattention to detail; thoughtless or premedi-

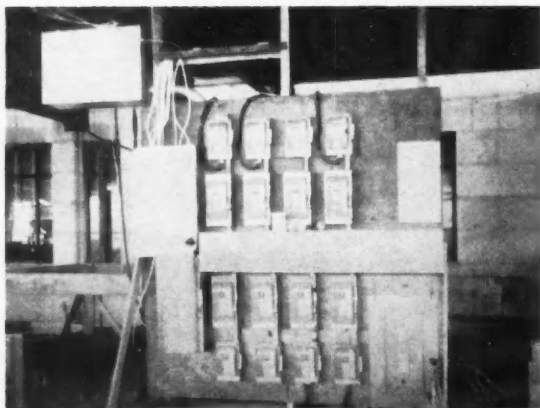
tated acts; distraction from the job at hand; lack of training, instruction, safe equipment and the observance of safety precautions, etc.,—were reported in 1959 by the National Office of Vital Statistics. This total represented an increase of 5.3% over the previous year.

By recognition of the basically hazardous exposures, so often associated with the use of electricity on construction projects, jobs can be pre-planned, protective measures can be provided, and work assignments can be given that will diminish, to a large extent, and eventually eliminate this waste of manpower through electrical accidents.

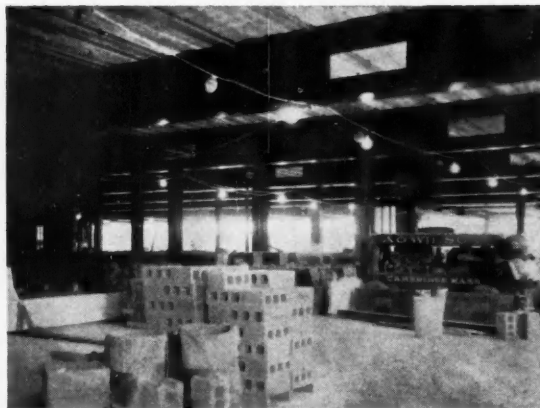
In the following discussion, the more common electrical installations found in construction projects are reviewed. For each situation, the hazards and applicable controls are outlined.

## Temporary Wiring

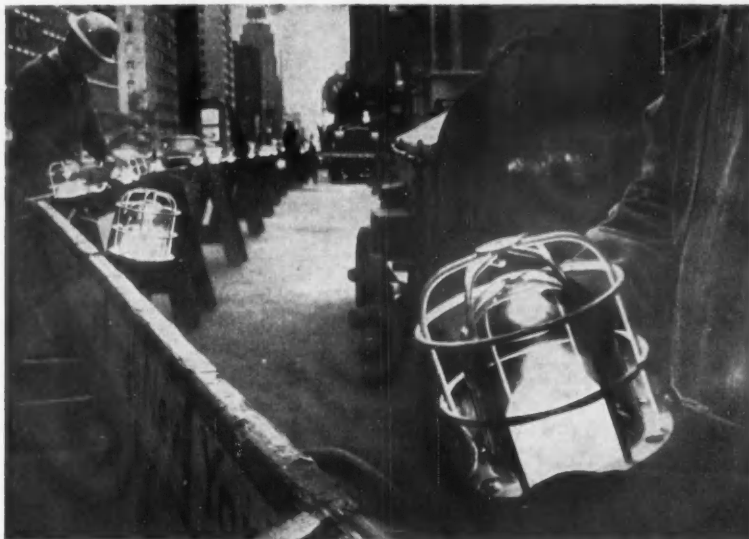
The use of temporary wiring should be discouraged even though it may be reasonably safe when first installed. As any construction job progresses and repairs or installations are made, temporary wiring may become unsafe because it is not properly protected from mechanical injury.



**FIG. 2**—In many construction jobs, lighting and power must be extended throughout the site as the work develops. While it is recognized that a permanent installation cannot be used in such cases, the principles of permanency should be kept in mind: appropriate wire to withstand exposures of environment; safeguarding of wire from mechanical or physical abuse; proper insulation of joints; grounding of dead metal; and inspection at periodic intervals as the work progresses.



**FIG. 3**—Care should be taken to see that the temporary wiring is strung to supports in the building and is elevated out of the path of all types of traffic.



**FIG. 1**—Protection of lamps against mechanical abuse by equipment or work processes should be provided. This road barricade isolates the lighting system which utilizes heavy lamp guards to protect against excessive breakage of bulbs. It also minimizes exposure to the hazards of electric shock.

In some construction jobs, the shops and office buildings are of a semi-permanent nature. In such locations, adequate wiring should be installed to recognize that the installation will be in place for some time.

In many jobs, lighting and power must be extended throughout the job as the work develops. While it is recognized that a permanent installation cannot be used for this purpose, the principles of the permanent installations may be used. See Fig. 2. This would include the use of an appropriate wire to withstand the exposures of the environment; the safeguarding of the wire from mechanical or physical damage by supporting it out of traffic lanes; the proper insulation of joints and connections to withstand the exposure of the environment; the grounding of dead metal; and the inspection of the installation periodically as the work develops.

### Temporary Lighting

Temporary lighting is utilized on many construction jobs and generally falls into two types. One type is the area lighting usually accomplished by means of floodlights mounted on structures or poles. In this type of installation, the standards of installation should compare rather closely with those for permanent wiring. Protection against mechanical abuse by equipment or

work processes should be provided at those points where conflict involving the electrical conductors is possible.

Ungrounded metal-shell sockets should not be used. Such a socket may become energized through contact with loose wires inside the socket, or through moisture in the socket insulation. Only porcelain, composition, or rubber-covered sockets should be used.

Ordinary twisted lamp cords should never be used for temporary lighting because the covering over the conductors is not designed to stand wear and abrasion in such service. Strings of temporary lights are available having covering on the conductors and molded rubber-covered sockets spaced at intervals. This equipment can be reclaimed after use and has a satisfactory working life.

Care should be taken to keep the temporary lighting string fastened to supports and elevated out of the path of traffic. See Fig. 3.

Extension cords should be of a type listed by UL. Kinking or excessive bending of the cord should be avoided to prevent the wire strands from breaking. Broken strands may pierce the insulated covering and become a shock or short-circuit hazard.

Type S cord or equivalent should be used with portable electric tools and with extension lamps. And special types of cord should be consid-

ered when the cord is to be used in areas where it will come in contact with oils or solvents.

Because the metal frames of portable electric equipment should be grounded, a cord with a green-covered conductor should be used with a polarized plug, and receptacle. If the location is not equipped with polarized receptacles, provisions should be made for accomplishing the protective grounding completely from the source to the tool.

All workmen who use electric power tools should be cautioned against: (1) grabbing the cord and jerking or pulling its cap from the wall receptacle; (2) allowing sharp objects to come in contact with the cord covering; (3) allowing heat, oil, or other rubber-softening solvents to accumulate on the cord; (4) dragging the cord over the floor or other rough surfaces; and (5) splicing cords which should be done by an electrician or other competent person.

Wherever possible, the electric cord of power tools should be suspended over aisles or work areas in such a way that they are out of the path of other workmen as well as objects and materials being moved.

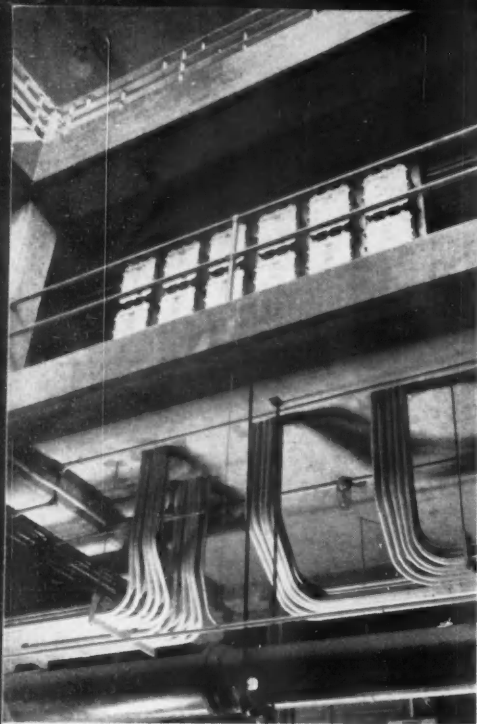
### Welding Operations

Neither ac or dc commercial power circuits are suitable for conventional arc welding processes. Consequently, to convert commercial power for arc welding, a motor generator or rectifier must be used for dc welding, and a transformer for ac welding.

Because, in many cases, the machines are moved about, convenient primary power receptacles should be provided about the job or construction site.

Some specific precautions for preventing electric shocks in welding operations are: (1) in confined places, cables may be exposed to damage from falling sparks. If they cannot be arranged to prevent contact with sparks, cover them with dry boards or other protection; (2) never change electrodes with bare hands or with wet gloves, or when standing on wet floors or grounded surfaces; (3) ground frames of electric welding machines, portable or stationary, in accordance with the NEC; (4) when in the course of work, a cable becomes worn, exposing bare

(Continued on page 235)



**INSTALLED 30 YEARS AGO**, aluminum conduit is embedded in concrete in many parts of the Easterly Sewage Plant, Cleveland, Ohio. This installation has not had corrosion of the encased conduits.

From the research lab . . .

# Use of Aluminum Conduit

Here are common questions and answers about practical job considerations in the installation of aluminum conduit in various environments.

By **Dixon Lewis**, Rome Cable Div. of Alcoa, Pittsburgh, Pa.

**T**WO topics of concern to conduit users have had considerable attention at Alcoa Research Laboratories. These are: atmospheric corrosion resistance of aluminum conduit; and performance of aluminum conduit embedded in concrete.

Here are typical questions that electrical contractors ask on these subjects, with answers based on recently completed research studies:

**Q. Does aluminum conduit need a protective coating of zinc, cadmium, enamel, paint, lacquer or chromate to prevent corrosion?**

**A.** No. Its natural coating of aluminum oxide is itself corrosion-inhibiting in most atmospheres and environments, and is self-healing when damaged.

**Q. We hear a lot about relative corrosion resistance of steel and aluminum conduit. Will you comment?**

**A.** Yes, and since this may be somewhat technical, let's take it one step at a time, and this time we will ask the questions.

**Q. What is corrosion?**

**A.** To answer this question strictly as it relates to conduit, corrosion is the progressive destruction of metals by reaction with their surrounding environments. Most experts believe that all corrosion is electrochemical in nature.

**Q. Is there more than one type of corrosion?**

**A.** Yes, and we'll try to make this explanation as simple as possible.

1. *Ordinary atmospheric corrosion* is the result of attack from impurities in the surrounding air. Clean, pure air and rainfall are kind to most metals, especially to aluminum, zinc, cadmium and copper, and the rate of corrosion is very slow. As impurities increase, such as near the seacoast and in contaminated industrial atmospheres, the rate of corrosion varies. Aluminum is particularly resistant to most atmospheric corrosion.

2. *Galvanic corrosion* requires two "dissimilar metals" and an "electrolyte," consisting of moisture containing some chemical or contaminant in solution that will conduct an electrical current. This combination forms a "galvanic cell" in which the metal higher in the galvanic series is corroded by electrochemical action. Fortunately, aluminum and zinc are quite compatible because they are very close together in the galvanic series and are not considered to be "dissimilar."

3. *Electrolytic corrosion* is similar in action to galvanic corrosion because there must be an electrolyte present and the corrosion is

electrochemical in nature. However, this type of corrosion also requires an externally applied electrical current, such as stray or leakage currents from faulty grounds or other sources. This type of corrosion is commonly called "electrolysis."

**Q. How does all this mumbo jumbo apply to conduits?**

**A.** Well, it simply means that we should know something about the environments in which conduits are installed, whether they be of aluminum, steel, fiber or plastic, so that the various types of corrosion can be minimized or prevented entirely.

**Q. Since aluminum and zinc are compatible, what practical application does this have?**

**A.** It means that for dry locations indoors and for outdoor installations where there is low moisture and relatively pure air, galvanized steel fittings can be used with aluminum conduit and aluminum fittings can be used with galvanized steel conduit. There will be little or no corrosion as long as the zinc remains intact. Where continuous moisture and contaminated atmosphere are known to exist, then aluminum fittings should be used with aluminum conduit.

**Q. A lot has been said about burial of aluminum conduit in con-**  
(Continued on page 236)





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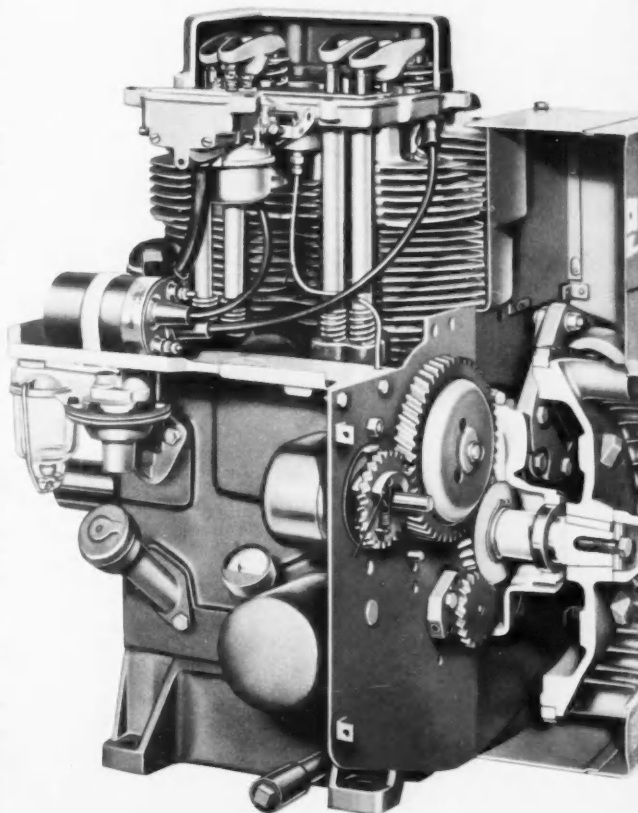
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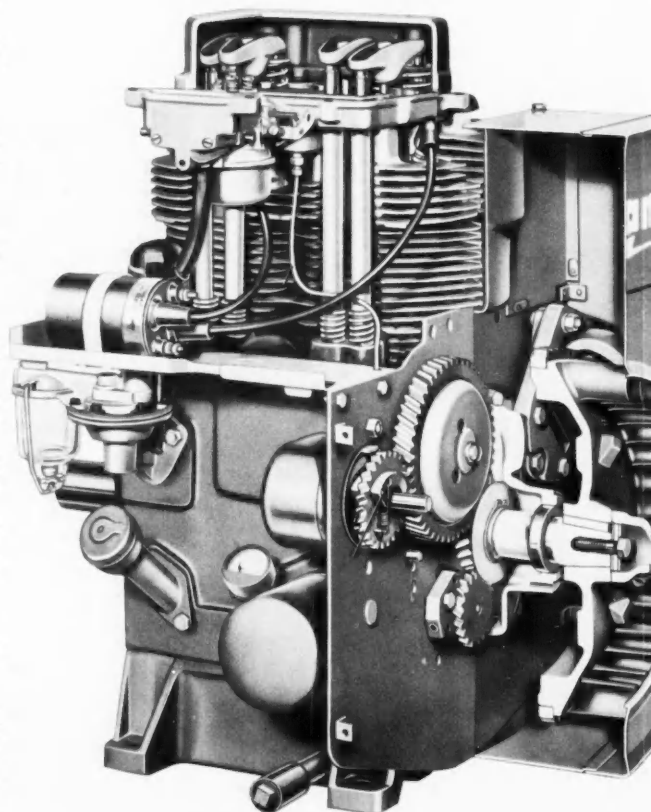
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**STATIC EXCITER**—Eliminates rotating exciter used in other types of generators.

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**CONSTRUCTION**—Only rugged coils and windings are used . . . will not go out of adjustment.

**SIMPLICITY**—Eliminates hundreds of electrical connections, commutator and its brush rig and many other potential "breakdown" points.

**EASY TO SERVICE**—All components are easily accessible, compared to rotating exciter generators which require complete dismantling for service.

**ADJUSTMENTS**—No "fine tuning" adjustments are necessary because regulation and stability are built in.

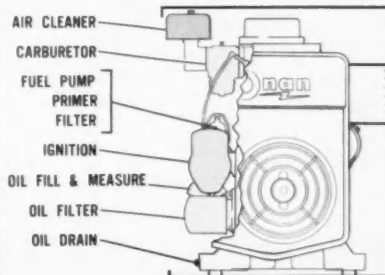
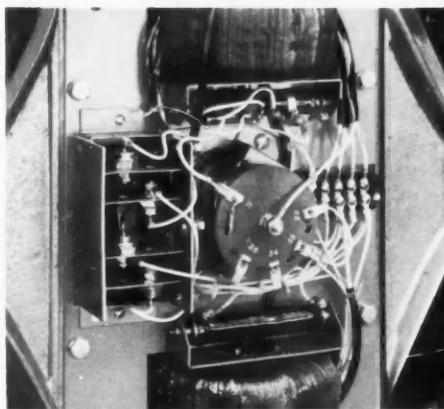
**VOLTAGE RECOVERY**—Rated voltage is restored in one second . . . compared to five seconds for rotating exciters.

**VOLTAGE FLUCTUATION**—Fluctuation with load changes is less than half that of rotating exciters.

## ACCESSORIES ON ONE SIDE FOR EASE OF SERVICE

The J-Line offers easy access to all components requiring periodic or occasional maintenance. All accessories (except the starter) are grouped on the left side. With this one-side service feature, users can locate Onan electric plant for fastest, most efficient maintenance . . . against a wall or in a tight compartment.

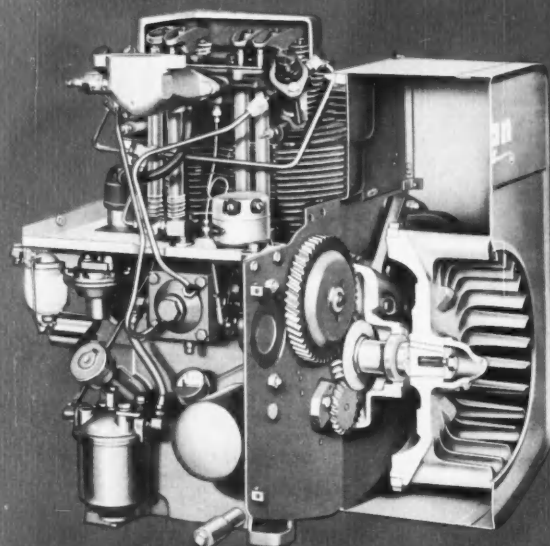
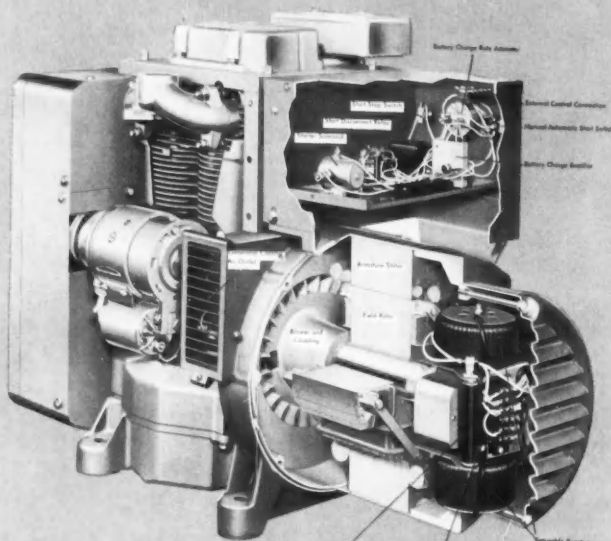
Also, with fuel pump and carburetor located in the coolest location, Onan engines are less sensitive to fuel vapor locks.



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PERFORMANCE CERTIFICATION**

## PERFORMANCE CERTIFIED

We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.



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# 51 REASONS WHY THE J-LINE IS YOUR BEST BUY...

- 1 UNITIZED CONSTRUCTION**—engine, generator and control designed to work together.
- 2 UNIT RESPONSIBILITY**—one manufacturer for the complete unit means one source of responsibility.
- 3 COMPACT PACKAGE** requires less installation space.
- 4 SIMILAR DIMENSIONS** permit greater interchangeability between units.
- 5 THOROUGH TESTING AND RUN-IN**—Every Onan Electric Plant undergoes hours of rigorous testing before being shipped.
- 6 WIDE RANGE OF CAPACITIES**—8 sizes from 3,000 to 15,000-watts.
- 7 12-VOLT D.C. OUTPUT** keeps starting batteries fully charged.
- 8 VIBRATION-FREE 4-cycle, 1, 2, and 4-cylinder engines.**
- 9 VERTICAL, OVERHEAD VALVE DESIGN** cuts down lead deposit buildup.
- 10 VARIETY OF FUEL OPTIONS**—Gasoline, gas, combination gas-gasoline or diesel fuel.
- 11 52 INTERCHANGEABLE PARTS** service 12 different engines.
- 12 LOWER COST REPLACEMENT PARTS** due to standardization.
- 13 SERVICE ACCESSIBILITY**—all service points accessible from one side of the unit.
- 14 MILITARY STANDARD** high mortality parts available.
- 15 VARIETY OF STARTING SYSTEMS** from hand crank to continuously gear engaged.
- 16 VARIETY OF GASOLINE IGNITION SYSTEMS**—flywheel magneto, battery or automotive distributor.
- 17 FULL PRESSURE LUBRICATION** guards against excessive wear to moving parts.
- 18 FULL FLOW OIL FILTER** standard on all models.
- 19 STELLITE VALVES AND SEATS** deliver up to 300% longer valve life than uncoated valves.
- 20 VALVES FREE TO ROTATE** for longer valve life; better compression; better performance.
- 21 HEAVY-DUTY CRANKSHAFT AND EXTRA-LARGE BEARING SURFACES** add muscle for extra years of performance.
- 22 DIESEL CRANKSHAFTS SHOTPEENED** for added strength without weight.
- 23 SPECIAL FLYWHEEL MAGNETO** on hand crank gasoline models starts the engine at as low as 100 rpm.
- 24 AMERICAN BOSCH DIESEL INJECTION SYSTEM** permits easy world-wide servicing.
- 25 HIGH DIESEL COMPRESSION RATIO** and pre-combustion chamber insure maximum fuel efficiency.
- 26 GLOW PLUGS AND AIR HEATERS** on diesel models insure quick starting.
- 27 PRIMARY AND SECONDARY DIESEL FUEL FILTERS** mounted on the engine.
- 28 SMOKELESS DIESEL OPERATION** up to rated load.
- 29 GASOLINE CARBURETOR** mounted in the cold air stream prevents vapor lock.
- 30 CHOICE OF AIR CLEANER**—Dry element type or optional oil bath air cleaner.
- 31 AUTOMATIC CHOKE** on electric gasoline models aids all-weather starting.
- 32 OIL PRESSURE GAUGE** standard on all units.
- 33 MECHANICAL, FLYBALL GOVERNOR**—pressure lubricated.
- 34 AUTOMATIC SPARK RETARD** on gas-gasoline models aids starting.
- 35 HAND FUEL PRIMER** on all diesel and manual starting gasoline models aids all-weather starting.
- 36 CHROME RINGS** on diesel models; optional on gas-gasoline versions.
- 37 POSITIVE LUBRICATION** to wrist pin and piston on diesel models.
- 38 "MAGNECITER" REVOLVING FIELD GENERATOR** with static exciter and voltage regulator on 6 KW models and larger.
- 39 VOLTAGE FLUCTUATION LESS THAN HALF** with static exciter as compared to rotating exciter.
- 40 ALL MOVING PARTS ELIMINATED** along with dozens of electrical connections on "Magneciter" generator.
- 41 GENERATOR SERVES AS CRANKING MOTOR** for starting on 5 KW models and smaller.
- 42 ALL STANDARD 50 AND 60-CYCLE VOLTAGES AVAILABLE.**
- 43 LARGE OVERLOAD CAPACITY.**
- 44 BATTERY CHARGE RATE AMMETER** standard on remote starting models.
- 45 RADIO SUPPRESSION EXCEEDS REQUIREMENTS** for most commercial applications.
- 46 VIBRATION DAMPER MOUNTS** as standard equipment cut vibration and noise to a minimum.
- 47 HOUSED UNITS EASILY COOLED**, having only one air inlet and one air outlet.
- 48 MUFFLER AND FLEXIBLE EXHAUST TUBING** standard on all units.
- 49 LIFTING EYES** on all units.
- 50 AUTOMATIC START-STOP AND LINE TRANSFER CONTROLS** built by Onan to match Onan Plants.
- 51 WIDE VARIETY OF OPTIONAL EQUIPMENT** to meet special requirements.

**ONAN** DIVISION of STUDEBAKER CORPORATION, MINNEAPOLIS 14, MINNESOTA



## PRACTICAL METHODS

### Power, Telephone and Air Services Contained In Floor Cavity

Ames Research Center at Moffett Field, Calif., has a new \$2-million Data Reduction Center where masses of information pertaining to manned satellites, ballistic missiles and proposed interplanetary craft, accumulated during daily research experiments, must be processed quickly and efficiently. For this purpose, electronic computers and advanced data-reduction equipment such as IBM 7090s and Honeywell 800s are present in considerable quantity. Such equipment is heavy; it demands critically maintained air conditioned environments, and it likewise calls for extensive electrical wiring.

To illustrate: in one section of the Center there are 20 items of equipment weighing as much as 8500 lbs each resulting in floor loads in the order of 200 psf. And, in the 7090 room alone, where large internal heat loads are present and where equipment will shut off automatically should temperatures reach 80°F, the air conditioning load amounts to 30 tons.

To support these loads, to convey temperature-and-humidity-controlled air, and to contain miles of power cables, signal circuits, telephone lines and sensing devices by which various computers and peripheral equipment convey information, five rooms in the Center have been constructed with lightweight honeycomb flooring panels elevated 15 in. above sub-slabs. This area approximates 10,000 sq ft in area; serves as a plenum chamber as well as a limitless wiring cavity; is composed of 2- by 4-ft panels supported by grid framing and adjustable-height steel pedestals; has a structural rating for supporting a uniform loading of 200 psi or a concentrated load of 1000 lbs without exceeding a deflection limitation of .04-in. at any point.

This special floor, one of the largest of its kind in the country, consists of steel face sheets bonded to 1-in. thick aluminum honeycomb cores and topped by pure vinyl. Adjustable pedestals, located at every intersection of grid framing as indicated in an accompanying illustration, are attached to sub-slabs by powder-driven anchor studs. And, although panels may be easily removed to provide complete under-



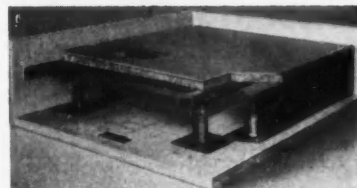
**CONCENTRATION** of data processing equipment demands flexible power facilities and critical air conditioned environment. In this installation, both objectives are provided by false flooring having limitless access and bearing resistance in magnitude of 200 psi. Room shown above also has dual-circuited 2-level lighting system and built-in vacuum-cleaning system to keep air free of dust and dirt.



**FLEXIBILITY** for wiring purposes is indicated by this photo showing access panels removed during installation period. Extent of electric circuiting is evidenced by size of control panels recessed in rear wall.

floor access, or interchanged for any reason, no indication of a false flooring is evident.

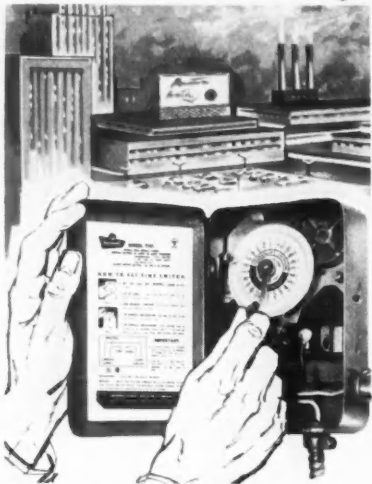
Because temperature and humidity control is of utmost importance, the raised floor is airtight in construction. Temperatures in the underfloor plenum are carefully regulated at 65°F, while mixing of underfloor air with a separate air source in the ceiling plenum results in a room temperature between 70-72 degrees with a strict humidity limitation of 43.5-46.5%. This mixed air is poured into the Center's five adjacent computer rooms



**PANELS** constituting upper floor consist of 1-in. thick aluminum honeycomb cores bonded to steel faceplates and topped by pure vinyl sheeting. Pedestals, adjustable for exact height, are secured to under-slab by means of powder-activated studs. Deflection of panel under uniform loading of 200 psi or concentrated load of 1000 lbs is less than .04 in.

# WHEN PERFORMANCE REALLY COUNTS! control it

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Electrical contractors know and rely on rugged, dependable, T-Rated Intermatic switches. Built to perform continually under the most extreme conditions, Intermatic provides the reliability and accuracy necessary to meet the toughest, most demanding requirements—and you can depend on them. Fast, easy installation, fewer customer callbacks save you time and money. Engineered and built to give you more for your money, Intermatic switches build your reputation with customer satisfaction. Reliable quality—that's Intermatic!

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SNAP-OUT MECHANISM, fast and easy to mount ■ 31 CUBIC INCHES of wiring space in the case ■ HEAVY-DUTY ALLOY-T CONTACTS (40 amps—4375 watts tungsten rated) ■ HI-POWER SWITCHING MECHANISM and U-BEAM SWITCH BLADES for fast, clean, make and break ■ E-Z SEE DIAL for rapid settings.

### OVER 100 MODELS TO CHOOSE FROM!

- 125 to 250 Volts
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- 1 to 96 operations per day
- Up to 55 amps
- Standard or "Skipper" models
- Astronomic Dial Switches
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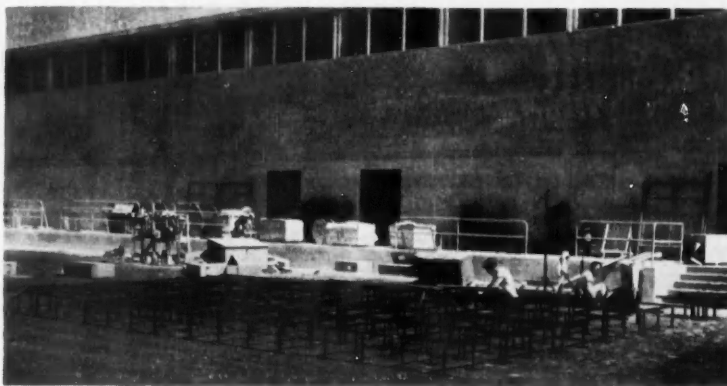
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**HONEYCOMB FLOORS** in five rooms of research center approximate 10,000 sq ft in total area. Pedestals and channel gridwork for support of false flooring were assembled on level outdoor parking area slab prior to installation indoors. Underfloor cavity has height of 15 in. above sub-slab.

at the rate of 12,000-15,000 cfm, while cooled air from the lower plenum is carried upwards directly to individual pieces of equipment through special cutouts in the raised floor.

In addition to these features, computer rooms have built-in vacuum-cleaning systems to keep them relatively dust- and dirt-free; strategically placed safety switches

by which all power can be shut off in cases of emergency; fiber glass ceilings and walls as a fireproofing agent, and recessed fluorescent trofers which are dual-circuited to permit 2-level lighting.

Architect-engineers for the project were Simpson, Stratta & Assoc., San Francisco, while flooring was fabricated by Associated Machine of Santa Clara.

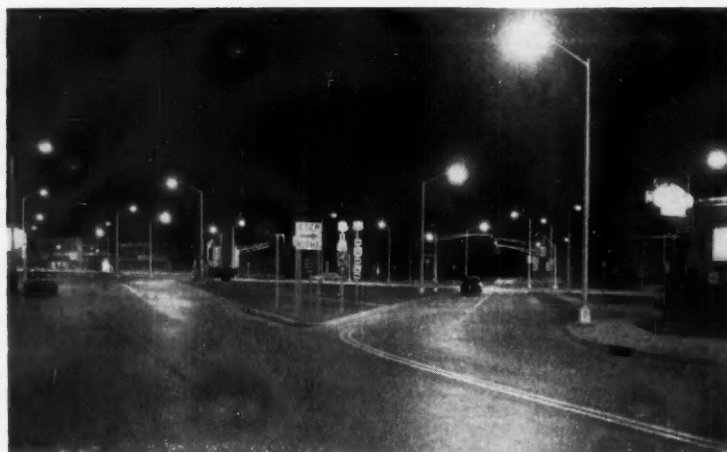
## Mercury Highlights An Interchange

Highway planners in New York State are taking a new look at highway interchange lighting requirements, as a result of a new high-intensity lighting installation in Kingston, N. Y., using mercury lamps and luminaires.

The new lighting system at the Kingston arterial interchange provides 3.3 footcandles initially in straightaway sections, and 4.3 foot-

candles in the central area. This compares with 0.8 to 1.0 footcandles of maintained light for interchange main travel lanes, as called for by New York State lighting standards, a specification considerably below the lighting level achieved by the new Kingston installation.

Utility and local State Department of Public Works division engineers had to present some persua-



**MERCURY** luminaires using 400-watt 20,000-lumen lamps, flood this highway arterial intersection with 4.3 footcandles. This interchange is at Kingston, N. Y., and the lighting has won the praise of both state and local officials.

# NOW IN SERVICE OVER 600,000 FT. OF SIMPLEX POLYETHYLENE INSULATED POWER CABLE

Voltages from  
15 KV to 46 KV



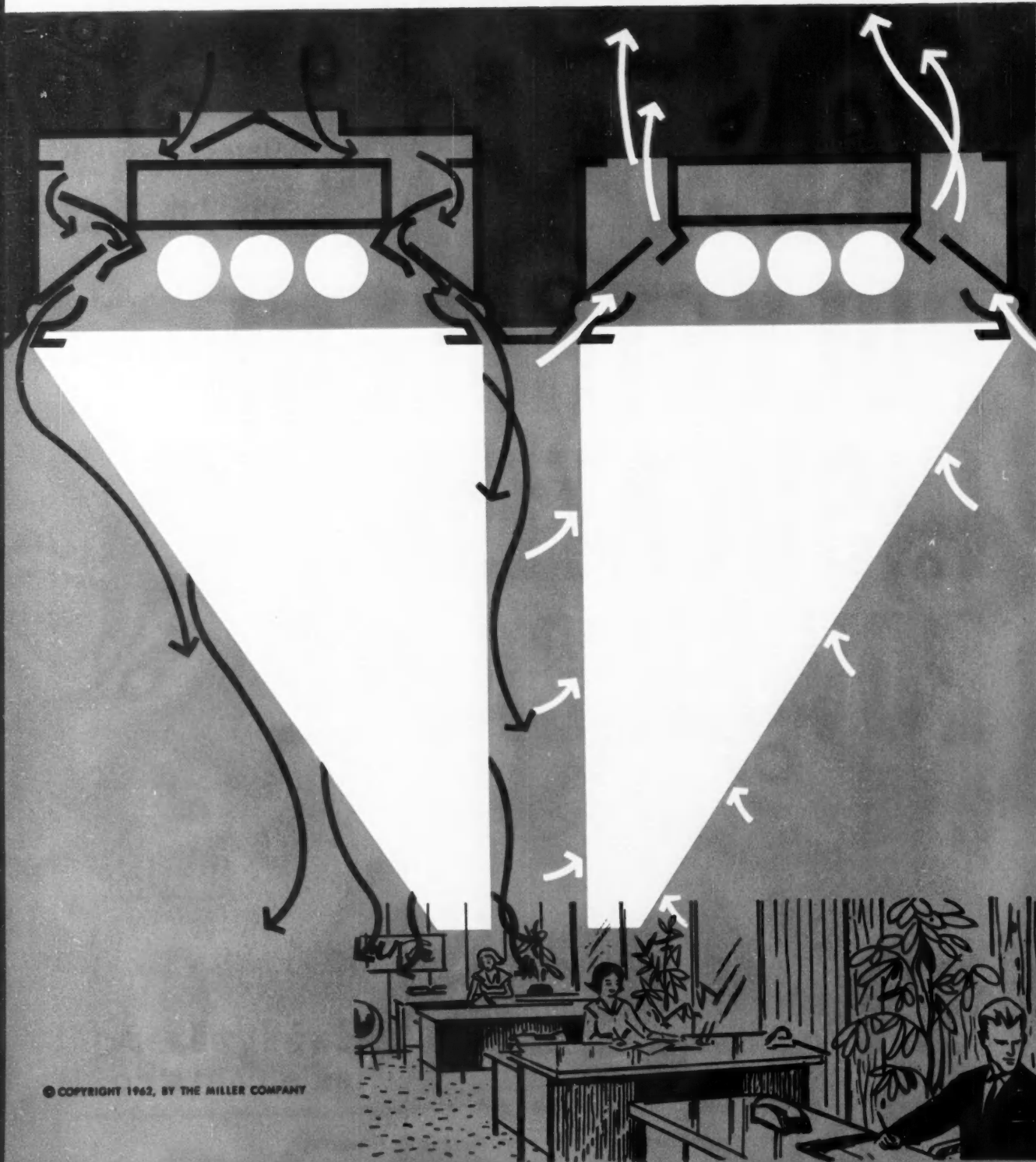
In installation after installation Simplex high voltage polyethylene-insulated power cable has proved itself to be a truly superior product. It combines the advantages of low dielectric loss with high dielectric strength and very high insulation resistance. And it retains these properties under service conditions. Typical applications include direct burial, duct or conduit, aerial and submarine. Write today for complete information.

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**ONLY miller MULTI-VENT<sup>®</sup> COMBINES LIGHT AND AIR**



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# TO GIVE YOU THESE EXCLUSIVE ADVANTAGES

Cleaner, more attractive looking ceilings and greater design flexibility to meet changing space requirements are two of the advantages to be gained when air diffusers are integrated with the lighting and acoustical module. In addition, a combination system **should** be less costly than separate systems. Also, it **should** limit the amount of lighting heat load that would normally enter the comfort zone. However, not all "combination" systems work together to accomplish these aims. **Multi-Vent is the only true combination light and air system.**

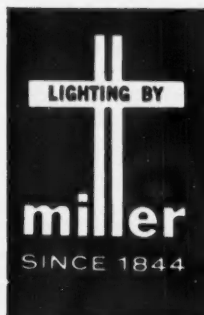
And, only Miller Multi-Vent troffers are so engineered that each function augments the other to provide these exclusive advantages:

- cost savings through heat pick-up
- lowest total cost
- up to 29% higher light output
- most comfortable air diffusion

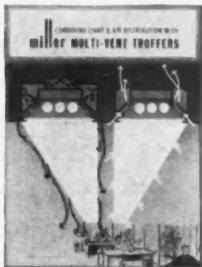
Take heat pick-up — the removal of fixture heat. Miller Multi-Vent is the **only** system whose return air outlets are designed to draw off at least 50% of the lamp wattage before it enters the occupied space. **Return air passes by the lamp compartments** and picks up a greater portion of lamp heat than with troffers where lamps are isolated from return air flow. And, when **plenum** return is used, air flow passes over supply and return units and picks up 11% of the ballast wattage. Thus, major cost savings are possible at the design stage. With less air volume required for control of room heat — less air handling capacity is needed. This means less ductwork, fewer and smaller fans, motors and filters and fewer troffers needed for air supply.

But greater savings through heat pick-up is just one of four exclusive advantages that you get with Miller Multi-Vent. See for yourself how you also get the lowest **total** cost, up to 29% higher light output and the most comfortable air diffusion. Before you design, engineer, specify, purchase or install **any** light and air system — be sure to get the full story on Miller Multi-Vent.

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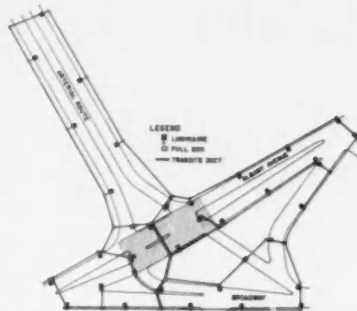


For complete information, write for the new and fully illustrated 30-page Miller Multi-Vent Manual.



**THE miller COMPANY**  
MERIDEN, CONNECTICUT • UTICA, OHIO

sive evidence in support of their recommendations, before headquarters' specifiers finally agreed to the plan. The lighting designers were told that they were taking a calculated risk by pushing the plan. If the new light levels proved to be "too bright," state officials cautioned, future attempts to raise light levels would be blocked at the beginning. However, the designers went ahead with their original plans, confident that the results would justify their proposal.



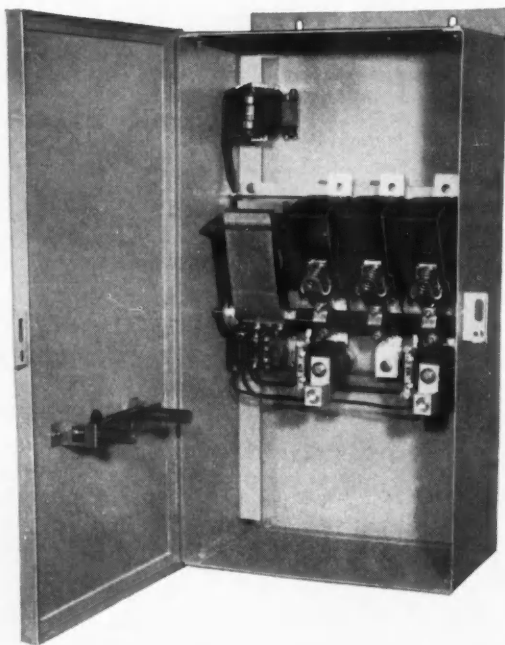
**LIGHTING** layout shows placement of mercury luminaires in arterial interchange at Kingston, N. Y. Thirty-seven 400-watt mercury luminaires provide 3.3 footcandles in straightaway sections, and 4.3 footcandles in the center (shaded) area. This is over three times the State's existing standard for highway interchange lighting.

The new lighting system, which has now been completed a few months, consists of 37 400-watt luminaires mounted 30 ft above the roadway on pole-mounted bracket arms. Luminaires are staggered, with spacings as close as 25 ft at strategic locations for the center of the interchange, and up to 75 ft on the straightaways. Each luminaire is equipped with a 400-watt 20,000-lumen mercury lamp. The total lighting load is approximately 15 kva.

Plans for the new lighting were prepared by R. L. Strickland, Central Hudson Gas and Electric Company engineer, in cooperation with engineers George Turner, K. G. Raver, and James Spratt of the New York State Department of Public Works, and submitted jointly to state highway officials in Albany, the state's Capitol.

The completed installation is considered highly successful. Kingston's Mayor has expressed gratification, both publicly and privately, and Department of Public Works officials concede this installation may prove to be a standard-setter, which could provide the inducement for higher lighting levels in future installations.

**Five reasons  
why you'll cut  
costs with  
Allis-Chalmers  
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heavy-duty  
control**



**NEXT TIME SOMEBODY TELLS YOU THERE'S NO DIFFERENCE IN LOW-VOLTAGE CONTACTORS . . . "TAKE FIVE" AND SEE WHAT'S NEW IN SIZE 4-9 CONTROL.**

Our HEAVY-DUTY size 4-9 starter design will *work* for you and assure reliability. Time-proved in the most difficult applications—in highly repetitive installations, dirty, abrasive and continuous duty jobs.

Get the combination of design you'll find only in Allis-Chalmers new, HEAVY-DUTY size 4-9 controllers to handle the tough jobs.

This is true HEAVY-DUTY control — *five ways* better for longer life, lower costs.

For example . . .

**1. DC Magnets Improve Efficiency**

Dc operators are standard on the *entire* line. They are unaffected by dirt and corrosion. They work more quietly, with minimum wear. Operating burden is lower with dc. Wide pickup and operating voltage lessens the effect of system disturbances. Low-inertia magnets reduce mechanical wear.



### 2. 110-Volt Control Circuit Protects Personnel

All pushbuttons and other control-circuit components operate on 110 volts for greater safety. This feature is standard throughout the line.

### 3. Self-Cleaning Contacts Assure Positive Conduction

These mill-type contactors have vertical contact surfaces (with "roll-and-wipe" action to limit contactor wear to non-current-carrying areas) so that dust and other particles cannot settle on them. This insures positive conduction between the closed contacts... regardless of the frequency of use. Self-aligning bearings on main contact shaft are trouble-free, lubricated for life.

### 4. ACBO Arc Chutes Eliminate Blowout Coils

ACBO arc chutes cool and extinguish the arc rapidly to minimize contact erosion and prolong contact life. And the arc chutes are easily removed without tools. You simply slip them out of place, for easy inspection of contacts and all other current-carrying components.

### 5. Front Connections Simplify Installation

All controllers through Size 6 are completely front-connected. So you save time and trouble on wiring. Larger sizes have rear connections to accommodate the larger cable required. Knockouts and terminals are easy to reach and identify.

Allis-Chalmers new **HEAVY-DUTY** starters and controllers are designed to perform the complete controlling functions for squirrel-cage induction motors... and the primary control functions for wound-rotor and synchronous motors. They can also be used to control power for static or resistive loads such as lighting and heating. The line includes full- and reduced-voltage, reversing and non-reversing, multi-speed and combination starters.

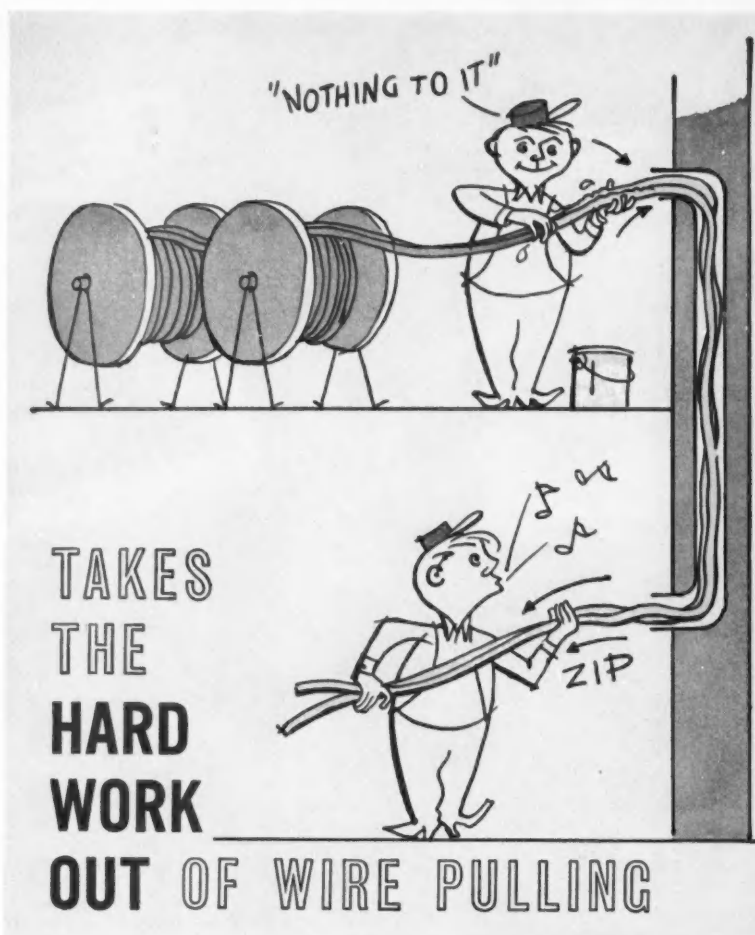
• • •

*For complete information and application assistance, see your A-C representative. Or write directly to Allis-Chalmers, Box 512, Milwaukee 1, Wisconsin. A-1690*

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**YELLOW 77** is a creamy textured compound with a wax base. Special additives make it form a slippery film all along the wire and conduit . . . *doesn't quit half way through . . . won't wash off in water.* Waxy film stays on so wires slip out easily, if ever necessary later. Quickly applied by hand, brush or cloth . . . isn't messy . . . smells good . . . safe! Free Contractor's Catalog gives all facts . . . get it now — send coupon . . .

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Company

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## Good Lighting Recognized As Leasing Inducement

Good lighting is an economic asset; attracting and holding tenants, justifying higher rentals and creating favorable public recognition. These conclusions influenced owners of the Central Towers Building, Phoenix, to approve a 4-times boost in illumination levels after initial plans and budgets had been adopted. Promoting these higher intensities was due to selling up by electrical engineer William Meir and lighting consultant Don Ruff of Arizona Public Service.

When advertising brochures were prepared, these higher lighting values were mentioned as a leasing inducement, and each lease carried the guarantee of "at least 50 fc" in all offices in this 108,000 sq ft commercial structure. It also was decided to leave all lights on until midnight, with the result that Central Towers was soon identified as an easily recognized downtown landmark.

Lighting, as initially planned, contemplated using fixtures with bare fluorescent lamps. 2-lamp fixtures were to be mounted separately, a plan which would have resulted in uneven, low intensity illumination. Now, however, fixtures are louvered and mounted in continuous rows, the result being a shielded installation with average illumination values "well above" the 50 fc minimum specified in leases.

Lighting is controlled from central circuit-breaker panels, rather than from local office



**LIGHTED LANDMARK** in downtown Phoenix employs continuous rows of louvered, fluorescent fixtures. Lighting, which is controlled from central circuit breaker panels, remains on until cleaning crews complete their rounds "sometime after midnight."





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32-page explosion-proof reference covers Explosion-Proof Housings • Control Stations with Pilot Lights, Push Buttons and Selector Switches • Instrument Housings with Glass Windows • Junction Boxes and Housings. Also a host of accessory "XP" equipment. Complete with photos, dimensions, and engineering detail.

**THE Adalet MANUFACTURING COMPANY**  
14300 Lorain Avenue • Cleveland 11, Ohio

switches. Lights are turned off by maintenance personnel after nightly cleaning is completed "sometime after midnight," at which time accompanying photo was taken.

Due to adoption of this louvered, higher intensity, more costly lighting installation, it seemed feasible and justifiable to correspondingly increase rental rates. And, since offices were completely rented by the time the building was completed, it may be stated that the extra cost for better lighting was amortized from higher rentals within six months.

### Denver Lighting Firms Cooperate to Illuminate Public Flower Show

Attractively illuminating 26 separate garden settings containing thousands of colorful flowers and shrubs is a large assignment, especially when funds to cover expenses of labor and equipment are nonexistent. This request was directed to central-Colorado electrical contractors, fixture suppliers and utility personnel when the non-profit Botanic Gardens Foundation of Denver planned their first show. Another problem related to location, since the exhibition was held in an inadequately wired 60-year-old Stockyard Stadium. Yet, through volunteered contributions of materials and effort, this barren structure was converted into an impressive floral display, with lighting, humidity and temperatures carefully created and maintained to preserve blooms in full colors and freshness for four days.

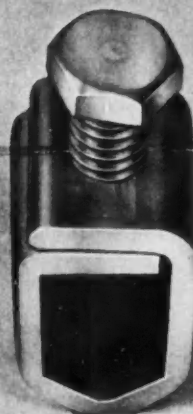
In planning the lighting, a budgetless electrical "committee at



**TRANSLUCENT PYLON** of blue plastic is transilluminated by 40-watt white fluorescent lamps mounted-in-tandem inside the 2-ft-dia tower. Water splashes over series of saucers to illuminated pool at base. Foreground flower bed and background boulders and trees are lighted by foliage-shielded floodlamps.



**SCRULUG connections are safe and secure.**



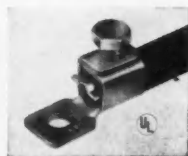
**No loose tongues.**

Nothing is more irritating than a loose tongue. Except high installation costs. Eliminate both with a Burndy SCRULUG®.

No matter how you shake it, nothing falls out of a SCRULUG. No pieces to pick up . . . especially offset tongues. It goes without saying that since SCRULUG cuts down installed time, it cuts down installed cost. But we'll say it anyway. For emphasis.

The captured internal pressure bar is the equalizer. It distributes equal pressure over the conductor and prevents the screw from cutting into the cable.

If you're terminating cable at safety switches, relays, electric control or signal equipment, you need SCRULUG. Contact your Burndy distributor for details.

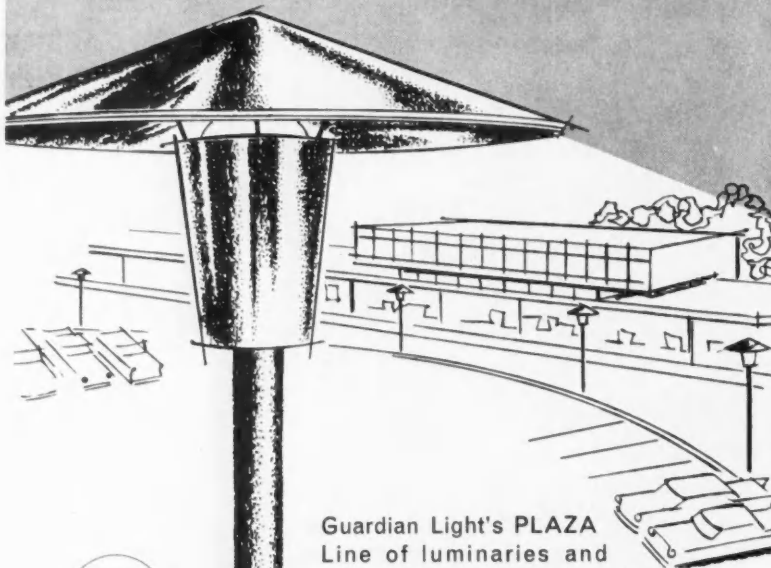


**BURNDY**

Norwalk, Connect.

# PLAZA LINE

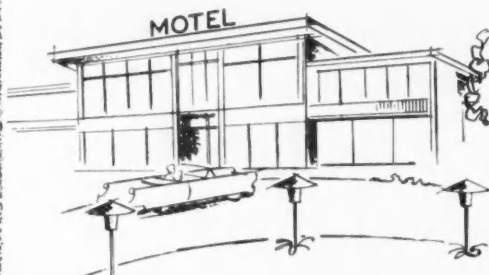
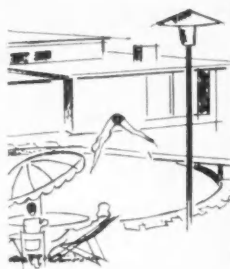
DESIGNED FOR FILAMENT,  
REFLECTOR OR MERCURY LAMPS



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for outdoor  
operation

Guardian Light's PLAZA Line of luminaries and poles is designed and engineered to combine beauty, efficiency and economy, utilizing filament, reflector or mercury lamps.

The fixture, fabricated from spun aluminum shapes, is styled to subtly complement both architectural and landscape themes. And, because it mounts directly to the pole with a cast pole adapter, no supports are required. Installation is durable, easy and economical.

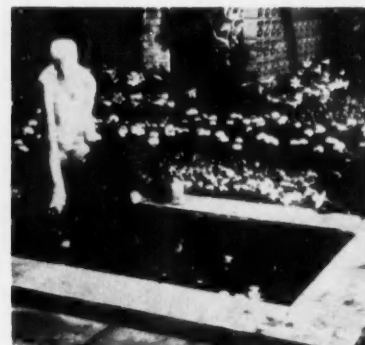


Write or wire for descriptive bulletin. Address Dept. E

**GUARDIAN** *Light* **COMPANY**  
500 NORTH BLVD. OAK PARK, ILLINOIS

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**BULLET FIXTURES** mounted along pool parapet highlight statuary in garden setting created for Denver Botanic Gardens display. Closely spaced 25-watt lamps, shielded by series of leaf-shaped reflectors placed along walkway, are installed to emphasize detail of patterned concrete curtain wall in background.

large" selected fixtures which would best represent a cross-section of the garden-lighting field. Selections ranged from low-cost mushroom caps to handwrought illuminated toadstools and whimsical metal flowers.

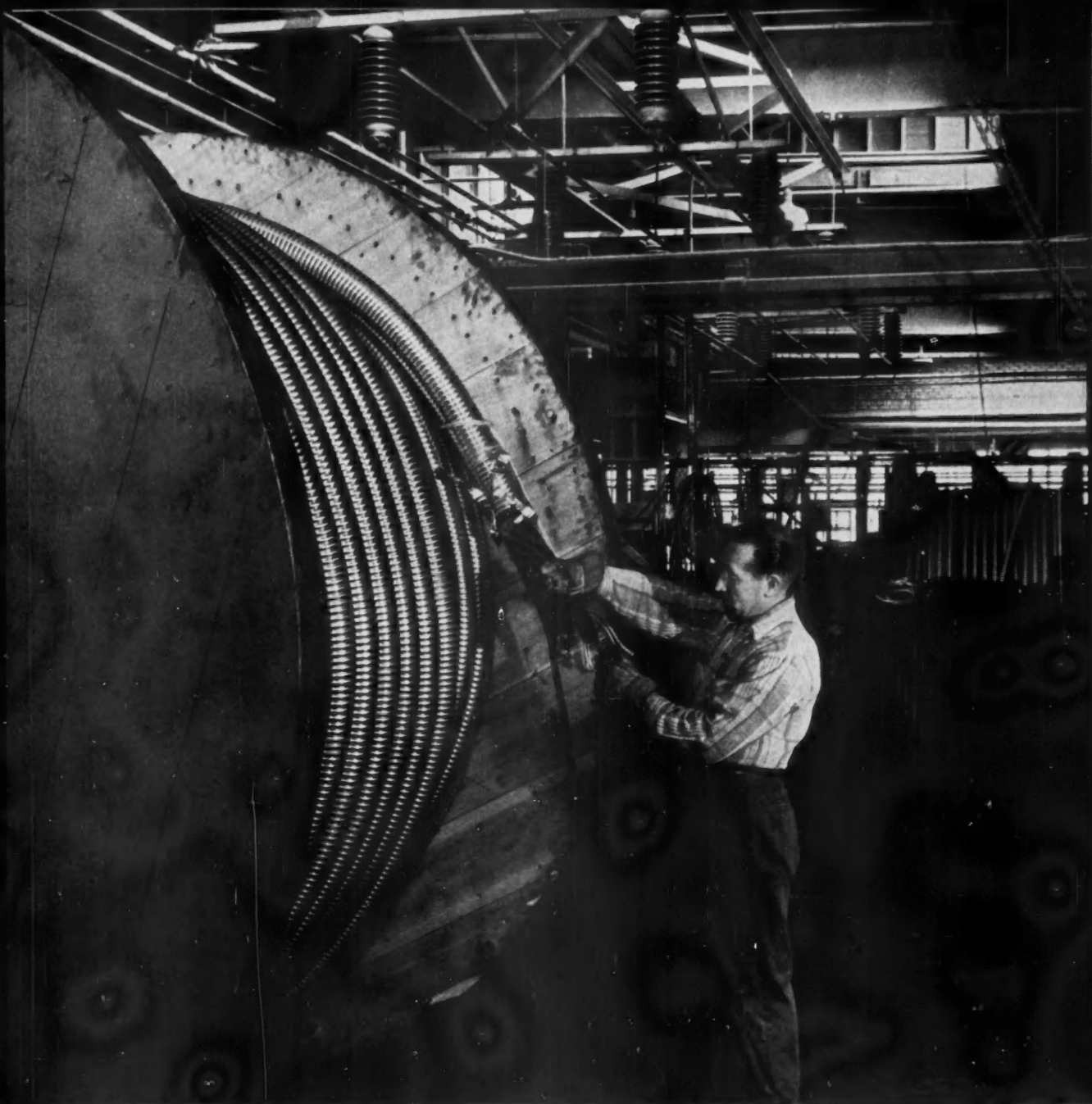
In this installation a central highlight consisted of a 30-ft-high 2-ft-dia blue plastic translucent pylon. This was transilluminated by 40-watt white fluorescent lamps mounted end-to-end inside the tower. Animation was provided by water splashing over a succession of offset saucers into a 20-ft-wide pool. Surrounding flower beds were illuminated by 150-watt pink lamps concealed in mushroom fixtures. Spotlights, shielded by foliage and planting arrangements, emphasized form and texture of huge background boulders and birches.

Another display featured a statue, which was illuminated by R20 reflector lamps placed nearby in ornamental bullet-type fixtures. Backgrounds of plants and patterned precast concrete-block curtain-walls were enhanced by 25-watt border lights shielded by green-enameled leaf-shaped units.

A third treatment created a pleasing background by installing a continuous strip of blue fluorescent lamps behind a series of blue plastic fence panels. In front of these panels, a statue was uplighted by plant-concealed upturned spots, while foreground blooms were floodlighted by popular parasol-canopied fixtures.

An effective elevated general-viewing terrace also was created with rock parapets, evergreen shrubbery and flowers illuminated by a variety of ornamental walk-





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This Circle power cable is undergoing its final performance test before being shipped. Shown here is the IPCEA-NEMA "double-voltage" test for dielectric strength. You can rest assured the Circle cable will pass it with an extra margin of safety. Circle cable also excels in ozone resistance, long term stability and other essential cable requirements.

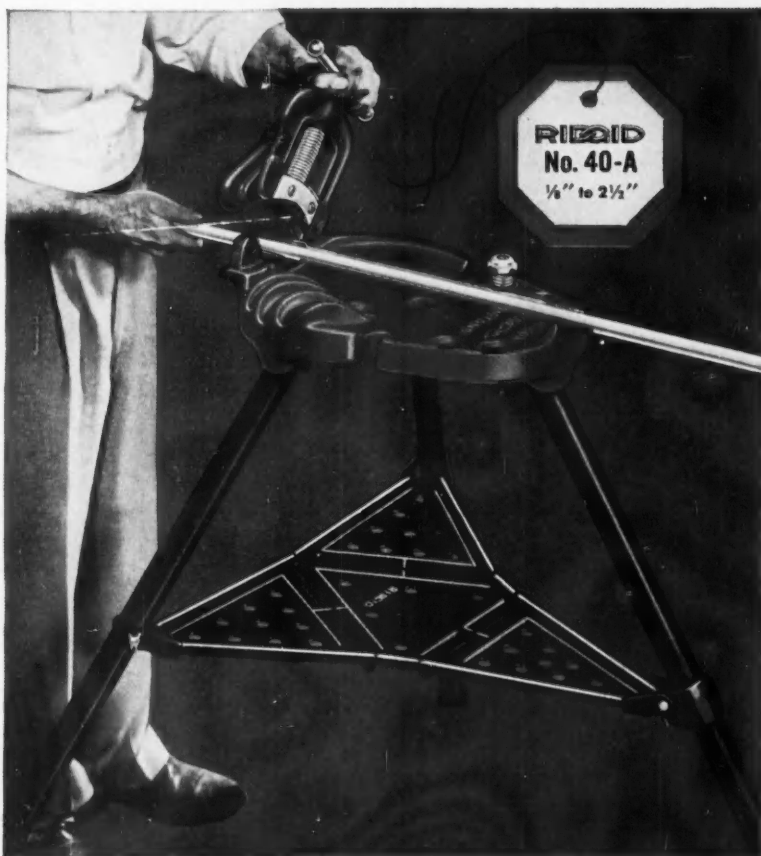
Manufacturing high reliability power cable requires expert knowledge of compounding and production that comes only from years of experience. You can get this experience at Circle...plus fast, dependable service. Be sure to specify Circle cable on your next job.



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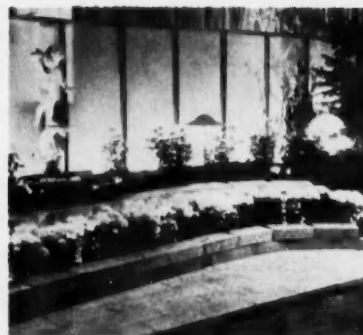
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Call your Distributor today. For your convenience, he maintains a complete stock of **RIDGID** Work-Saver Pipe Tools and parts.



**PLASTIC PANELS** are backlit by continuous strip of blue fluorescent lamps. Panels constitute pleasing background for flower border and statue, which are floodlighted by combination of parafix fixtures, concealed upturned spots and overhead narrow-beam shielded spotlights.

lights, hidden floods and hooded downlights. Lights also were placed beneath and behind benches on the terrace, thereby silhouetting seats to identify them for those who sought rest. These shielded lights also directed spill-light downwards to walkways for safety purposes, and projected low-key lighting upwards to softly illuminate background pines, aspens and birches.

Since accompanying illustrations are black-and-white prints of 35-mm colored slides, considerable color and detail is lacking. Photos do, however, provide an indication of various lighting treatments installed by members of the Denver electrical industry and the IES Rocky Mountain Section.

Lighting equipment in this public-spirited cooperative project approximated \$8000. Floral displays had an estimated retail value of \$175,000. To handle the temporary electrical load, the local utility provided a 35-kw service entrance and booth distribution system. During the four-day show, over 30,000 people visited the displays enjoying floral beauty enhanced by recommended garden-lighting techniques.

Responsible for organizing this industry contribution was a committee including James E. Watson, Fluorescent Maintenance; Ernie Graham, Belmont Electric; Gregg Cloos, Gregg Cloos and Co.; Fred Rosenquist, Public Service of Colorado; Harold Gypson, Holophane; Pat Patterson, General Electric Supply; Gerald Hanley, General Electric Lamp Dept., and Harold Brandt, Westinghouse Lamp Dept. Wholesalers furnishing fixtures included Rite Lite, Central Electric and Poindexter.



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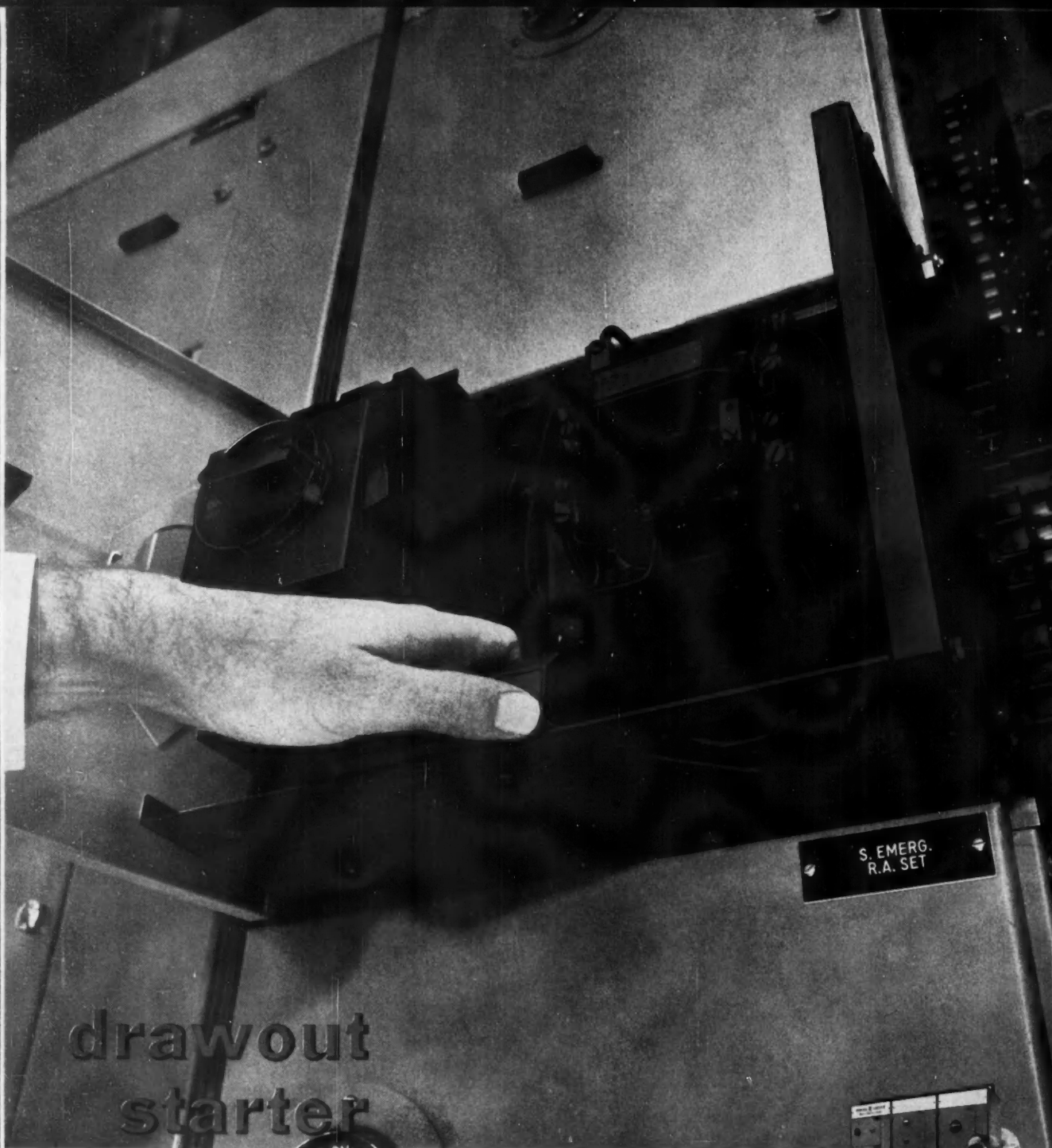
New Permacel Junction Box Mount epoxy adhesive... the fast, easy way to attach junction boxes to any surface.

Money back and a new roll of tape if Permacel 295 does not perform as stated above. Permacel Junction Box Mount is guaranteed for a period of one year from date of purchase not to harden in the cup until mixed or until divider section is removed.

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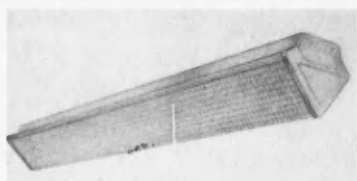
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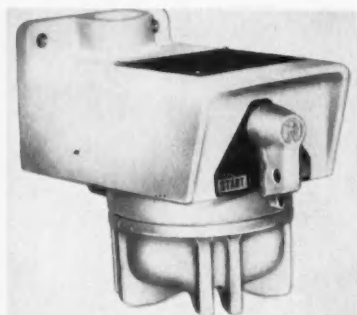
# Product News



## Lighting Fixture (1)

A new V.C.U. fluorescent luminaire for corridor, aisle or stack lighting, has been announced. The V.C.U. has been redesigned shallower to provide wall-to-wall illumination with lengthwise brightness. Baskets are one-piece "V" designed of standard Gratelite louver diffuser or Prismoid Gratelite louver diffuser and are framed-in-steel. Baskets can be hinged from either side for servicing. Baskets are available in 4-ft lengths only. Channels are in one-piece 4- and 8-ft lengths for 430, 800 or 1500 ma operation. Units can be surface or pendant mounted, singly or in continuous rows. Bulletin is available.

Edwin F. Guth Co., 2615 Washington Blvd., P. O. Box 7079, St. Louis 77, Mo.



## Conduit Fittings (2)

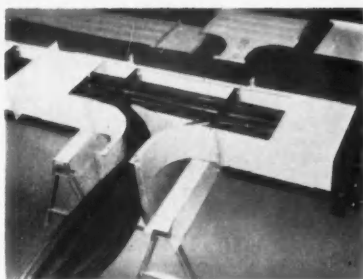
Explosion-proof wiring device conduit fittings for use primarily in Group B locations containing hydrogen are furnished complete with tumbler switch, Size 00 manual motor starters, pushbutton stations or selector switches. The Pylets, identified as the EWA Series, are front operated and have threaded construction. External operating handle attached to a threaded stainless steel shaft is protected from rain and process drippings as well as mechanical injury by a hood cast integral with the body. Literature is available.

Pyle-National Co., 1334 N. Kostner Ave., Chicago 51, Ill.

## Power Supply (3)

SCR (silicon controlled rectifier) power supply for adjustable dc voltage applications has been introduced. The solid state dc power supply, called Silcomatic, presently rated up to 1500 kw at 500 volts, will be used to supply dc motor armatures in metal rolling, paper making, and mining. High kilowatt ratings at 700 volts will be introduced during 1963. Rectifiers are used as the basic power unit. They provide the high speed of response to achieve maximum performance from the system.

General Electric's Low Voltage Switchgear Dept., Philadelphia, Pa.



## Cable Bus Duct (4)

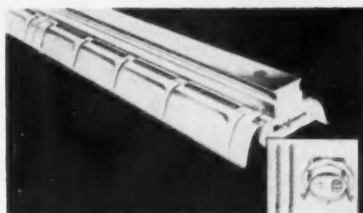
A new cable bus duct, preassembled in lengths up to 80 ft, is available. It comes equipped with all devices required for joining adjacent cable sections or terminations. Cable bus duct is being fabricated in either ventilated or weatherproof aluminum enclosures for either indoor or outdoor use. It is available in 600- to 23,000-volt ranges in various ampere ratings from 600 up to 5,000. Higher current ratings can be furnished.

Anaconda Wire and Cable Co., 25 Broadway, New York 4, N. Y.

## Outdoor Lighting (5)

A completely new line of area lighting devices has been introduced. Bonita and Lumi Post units are used in campuses and shopping centers, outside motels and restaurants. Color tones are rouge, gold and lime. Matched tapered aluminum poles are available for straight or davit mounting in a variety of heights and mounting methods. Literature is available.

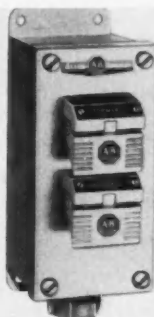
Silvray Lighting, Inc., 100 W. Main St., Bound Brook, N. J.



## Lighting Fixtures (6)

A new line of fluorescent lighting fixtures featuring a new hanger system has been introduced. Known as the Task-Master series, the line includes three models: a 40-watt rapid start unit, 4 ft in length, 10% upward diffusion of light (through slots in top of reflector); a 96-in. Slimline model with 10% upward diffusion and 96-in. Power Groove SHO or VHO model with 25% upward component. All models feature two fluorescent lamps in parallel in the 4-ft or 8-ft lengths and 13° crosswise shielding.

Benjamin Division, Thomas Industries Inc., 207 E. Broadway, Louisville 2, Ky.

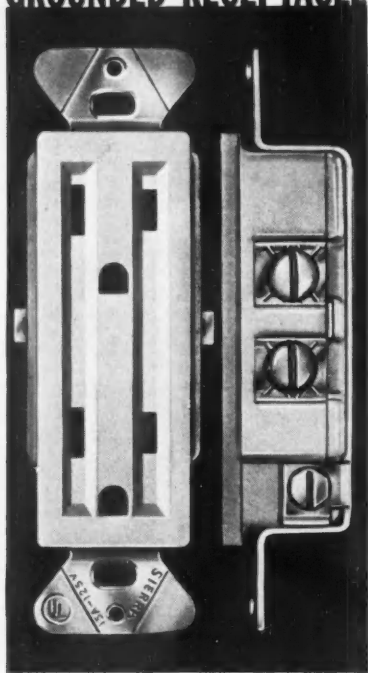


## Control Stations (7)

A new line of NEMA Type 4 watertight and weatherproof, and NEMA Type 4X corrosion-proof heavy duty control stations, has been introduced. The watertight control stations have a stainless steel enclosure with a gasket between cover and base. Enclosures are made of No. 304 stainless steel. Designated as Bulletin 800, stations are designed for use in control circuits of magnetic starters and control panels. Stations are available with pushbuttons, selector switches, selector pushbuttons and pilot lights. Contact ratings are from 6 amps, 110 volts to 1.2 amps, 550 volts ac.

Allen-Bradley Co., 102-L West Greenfield Ave., Milwaukee 4, Wis.

# NEW SIERRA BIPLEX GROUNDED RECEPTACLE



PAT. PEND.

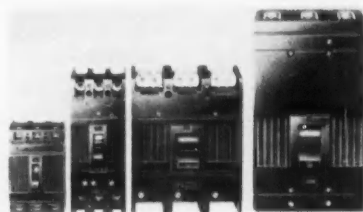
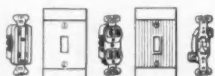
Biplex is the name for this handsome new duplex receptacle that adds a touch of elegance to your projects—at budget prices! This grounded duplex matches the 2-wire Sierra Triplex and fits the same plates. Biplex is UL approved and meets all codes and standards.

## SIERRA BIPLEX

**SIERRA ELECTRIC CORPORATION**

15100 SOUTH FIGUEROA STREET  
BOX 85, GARDENA, CALIFORNIA

Write for more information and catalog



### Circuit Breakers

(8)

A major improvement in calibrating four new frame sizes of molded case circuit breakers, from 15 to 1000 amps, has been announced. The new F 225 and J 400 breaker lines are ambient compensated as a standard feature. They are calibrated for their full rating in ambient temperature up to 50°C. Beyond this temperature, they will respond to temperature increases to prevent damage to conductors and insulation rated for a 30°C ambient. They comply with newly established UL calibration procedures for ambient compensated thermal breakers. Breakers in 100- and 1000-amp frames are enclosure compensated for rating of 40°C ambient temperature in open air. Improved adjustable magnetic trips are available for short circuit protection. Bulletin is available.

Circuit Protective Devices Dept.,  
General Electric Co., Plainville,  
Conn.

### Lamps

(9)

A new line of PAR (parabolic aluminized reflector) lamps for high intensity spot or floodlighting applications has been announced. Floodlights are designed for use in broad area, short-distance applications, such as parking lot lights, and in industrial areas. Lamps are designated PAR46, PAR56 and PAR64.

Lighting Products Div., Sylvania  
Electric Products Inc., Salem, Mass.

### Industrial Fixture

(10)

A new line of industrial luminaires featuring porcelainized enamel finish has been announced. Designed for all types of industrial applications, the fixtures, designated Hi-Q-Line, offer a wide range of illumination intensities in several millampere ratings, including 1500 MA for higher output operation. Fixtures feature heavy gauge porcelain reflectors embossed with lateral reinforcing ribs. The line consists of two series: the X320, providing upward lighting of 10%

and 13° crosswise shielding; and X350, providing 25% upward lighting, with a center baffle that increases shielding to 26°. Both units are listed by UL.

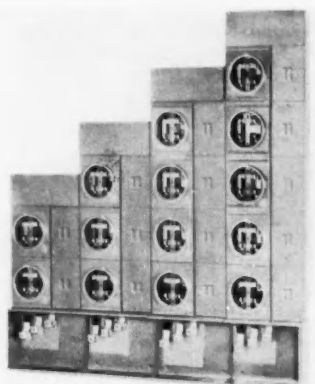
Sunbeam Lighting Co., 777 East  
14th Place, Los Angeles 21, Calif.

### Hammer Drill

(11)

A heavy-duty hammer-drill, Catalog No. 716, has been added to this line. A turn of its collar mechanism changes the action from direct-drilling to percussion-drilling. As a drill it will take twist drill bits, wood augers, self-feed wood bits, masonry drill bits, and hole saws. As a hammer, it will percussion-drill in concrete, porcelain, brick, tile and other similar materials, and may be used for the installation of 1/4 in. through 1/2 in. bolt size, flush, stud, tie wire, rod hanger, lead plug and other types of expansion shells and anchors.

Black & Decker Manufacturing  
Co., Towson 4, Md.



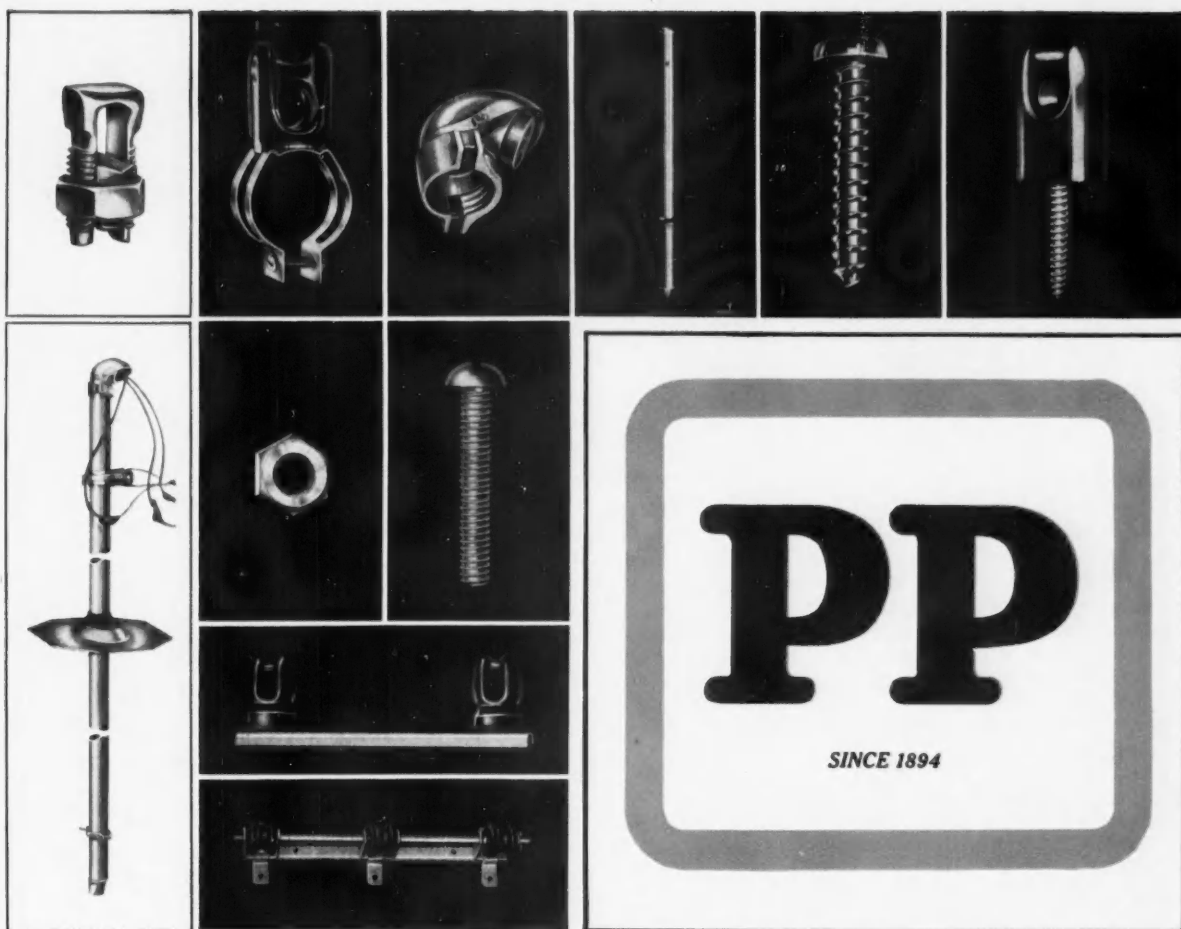
### Meter Channels

(12)

New gangable "VB" series meter channels are panel base assemblies suitable for use as service equipment. All units are UL listed as panel base assemblies, suitable for use as service equipment and available in modules from two to six stations high. Each module can be stepped or ganged. Meter sockets are line bussed, 10-in. on vertical centers to cover utility requirements. Line bussing extends into line gutter with 4/0-500 MCM "lay-in" type connectors. Channels are available with line or load gutters either at top or bottom. Channels accommodate main service disconnects when required for more than six sockets.

Anchor Mfg. Co., Division of  
Basic Products Corp., Manchester,  
N. H.



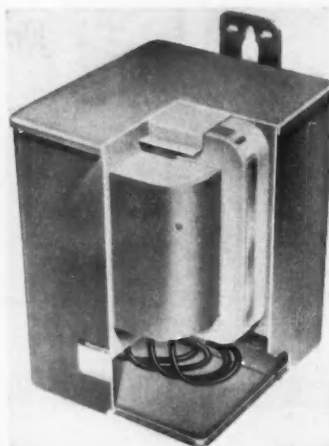


## Contractors' Electrical Supply items with a great name behind them.

You, as an electrical contractor, probably use one or more of these products every day and never give them a second thought. They're almost as common to you and your men as ... say, a pair of pliers. But we at Porcelain Products Co. give a lot of thought to their manufacture. We make them of the finest quality materials for long life, and design them for most efficient use. We're proud to have served electrical contractors throughout the country since 1894 ... and pledge to continue working to merit your confidence. We'll appreciate your specifying Porcelain Products Co. when buying any of the above or 115 other PP Co. items. They're stocked by most electrical wholesalers. For complete information in condensed form, send for our new Specifier Catalog—it's yours for the asking.

**PORCELAIN PRODUCTS COMPANY, Carey, Ohio**





### Transformers (13)

A complete line of 400-cycle dry-type transformers (EP, EPT, DS-3 and DT-3) from 500 kva, 600 volts and below, single and 3-phase, has been introduced. Units are suitable for indoor and outdoor service. Compound-filled construction of the EP and EPT transformers allows mounting in any position since core and coils are completely supported, and ventilating air ducts are not necessary. Units are built in accordance with the latest revisions of ASA, NEMA, and AIEE standards for transformers.

*Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.*

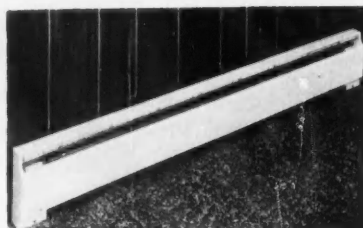


### Floodlight (14)

Mercury floodlight, known as "Cat's-Eye," produces a 164° horizontal beam while maintaining controlled vertical distribution. Unit utilizes a combination of elliptical and parabolic reflector contours to achieve its pattern of wide horizontal and controlled vertical light distribution. With a clear mercury lamp, the floodlight produces a 158° horizontal beam spread and a 39° vertical beam spread. When used with a phosphor-coated mercury lamp, the reflector delivers a horizontal beam spread of 164° and a vertical beam spread at 80°. A combination fitter-housing encloses a

choice of constant-wattage or reactor-type ballasts for common primary voltages. For use with remote ballasts, fitters are available without the housing and integral transformer.

*Revere Electric Mfg. Co., Chicago 48 (Niles), Ill.*



### Electric Heater (15)

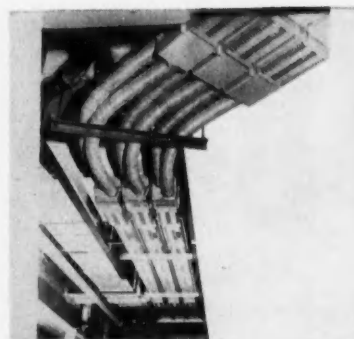
A new baseboard electric heater has been announced. The HiConvection heat chamber creates maximum air flow which forces heated air away from the wall into the room. Heated air is directed toward the occupied portion of the room rather than toward the ceiling. New integrally finned element. Heaters are supplied in 24-in. overall modules. A "watts density" of 240 watts per lineal foot is employed. Wiring compartments are located at either end (right end only on 2-ft section) and units contain safety cutouts every 14 in. to afford multiple protection against overheating in case of restricted air flow.

*Thermador, Division of Norris-Thermador Corp., 5119 District Blvd., Los Angeles 22, Calif.*

### Lighting Fixtures (16)

Development of a full line of outdoor lighting fixtures to meet diverse commercial, industrial and municipal requirements has been announced. A total of seven fixtures are included in the line. They include: the aperture fluorescent reflector (AFR), designed for use where a narrow, closely controlled light beam is needed. Controlled fluorescent reflector (CFR), designed for use where large areas must be illuminated with little light spill. The general purpose mercury (CPM) is designed for general lighting. Very narrow beam (VNB) is designed for unusual lighting jobs. The rail light, basically an AFR fixture in a rail, is designed for inclusion in bridge or viaduct railings.

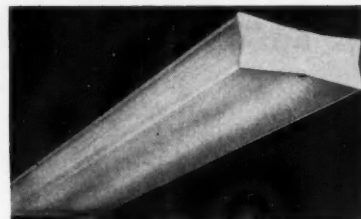
*Lighting Products Div. of Sylvania Electric Products Inc., Salem, Mass.*



### Busway System (17)

Complete busway systems that provide flexible transmission, distribution, protection and control for industrial plants, municipal and commercial buildings has been added to this low-voltage line. The protection of the Uni-Bus system of prefabricated, standardized busway and component products, consisting of ducts, centers and component parts, make it impossible to touch a live part during installation, maintenance and inspection. The plug-in feature allows new equipment to be installed without shutting down other machinery. Uni-Bus plug-in duct is available in six different types in a complete range of ratings, 100-4000 amps. Feeder ducts, also available in the Uni-Bus line, are electrically and mechanically compatible with the plug-in type. Both feeder and plug-in duct employ the same bus bar arrangement.

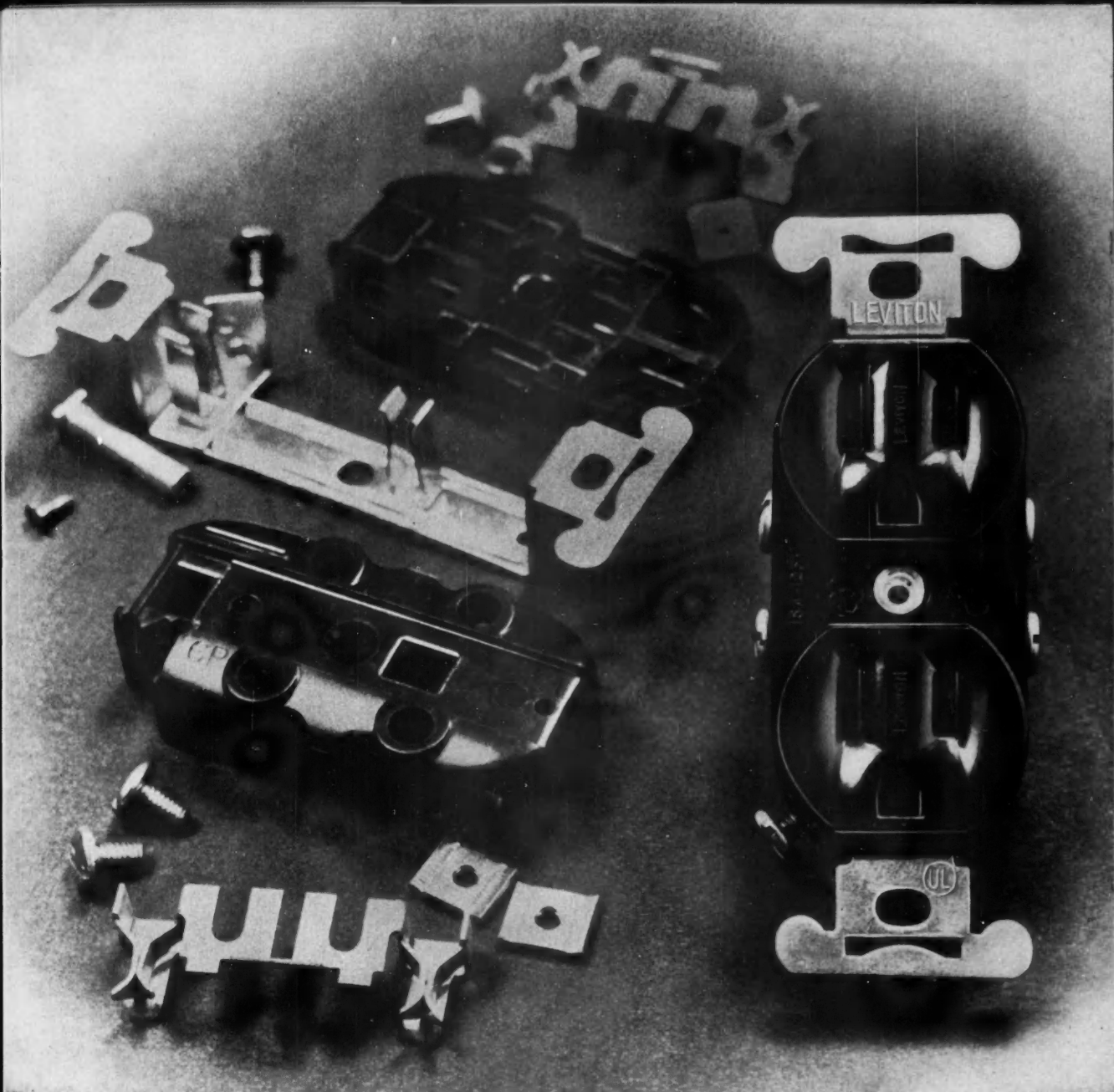
*Cutler-Hammer Inc., 315 North 12th St., Milwaukee 1, Wis.*



### Lighting Fixture (18)

The Geometric, a new surface mounted fixture, has been announced. It features a wrap-around prismatic type lens of clear, color stable plastic, also a mat-white diffuser. Available in both 2- and 4-light rapid start for stem or surface mounting, either as individual fixtures, or in continuous rows. Diffuser hinges from either side and can be removed without tools. Fixture is UL listed.

*Gibson Manufacturing Co., 1919 Piedmont Circle, N. E., Atlanta 9, Ga.*

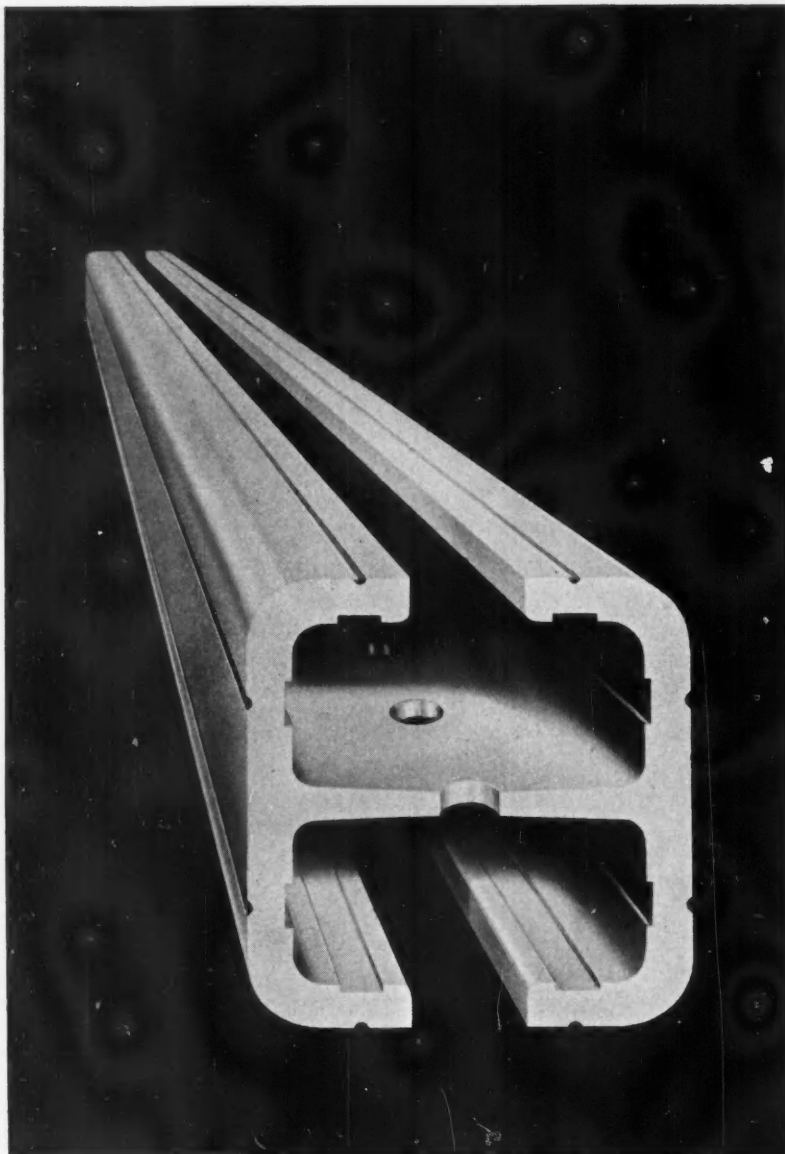


## DON'T TAKE OUR WORD FOR IT

Make the comparison test and find out for yourself. We'll match our quality with any other line on the market today selling at a higher price. Ours costs less, yes—but without any sacrifice of quality, performance or durability! How do we do it? We start from scratch with the raw materials needed to produce all the components that go into our product. Production of this rigidly tested product takes place on the most advanced, automated equipment available. Result: Basic economies! Take our product and a competitive one and pry them apart. Examine them, checking each part carefully against the other. See what we mean? Now check your price lists. That's where Leviton wins hands down. Don't you owe yourself this comparison test? ■ Write to Dept. EC1 for a free sample and see for yourself. It can only save you money. Leviton Manufacturing Co., Inc., Brooklyn 22, New York.

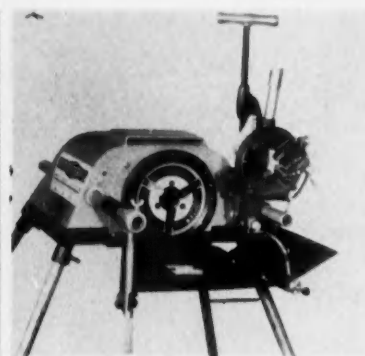


THE MAXIMUM PERFORMANCE PRODUCT



## Look at the shape this conductor is in!

It's Alcoa "IWC" (Integral Web Channel Bus) and it has a lot to offer! □ Web construction gives it high mechanical strength . . . able to withstand heavy fault current. Long unsupported runs are practical and economical. □ Joints, taps and splices are easier to make than on other types of bus. Note the flat surfaces and the grooves for automatic positioning of accessories. These features eliminate the need for expensive, bulky fittings and reduce on-site labor costs. □ Look into Alcoa IWC when you're planning to modernize or expand. For full information on this or any other of the standard Alcoa aluminum bus shapes, call or write your Rome-Alcoa representative or Rome Cable Division of Alcoa, Dept. 7-102, Rome, N. Y.



### Threading Machine (19)

A new portable, pipe threading machine for heavy duty service and complete with built in die-head, cutter, reamer and oil sump and pump has been announced. The built in, swing-over type die head is automatic in action. Two sets of threading dies handle the automatic opening ranges; one set for  $\frac{1}{4}$  in. and  $\frac{3}{8}$  in., and one set for 1 in. to 2 in. Manually operated, the die-head will also handle an extra range of  $\frac{1}{4}$  in. to  $\frac{3}{8}$  in. with two sets of pipe dies; and bolt or rod sizes from  $\frac{1}{4}$  in. to 2 in. with a set of dies for each size. The pipe cutter and reamer are also of the swing-over type for convenient operation and have a range from  $\frac{1}{4}$  in. to 2 in.

Oster Manufacturing Co., 1340 E. 289th St., Wickliffe, Ohio

### Lighting Fixtures (20)

Three new extra-shallow, surface-mounted fluorescent lighting fixtures have been developed. Available in sizes of 1 by 2 ft, 2 by 8 ft, and 4 by 4 ft, (series 6700, 4700 and 4900 respectively), their matching design permits illumination of all building areas with fixtures of uniform appearance. Depth of modular fixture is  $3\frac{1}{2}$  in. All fixtures feature two wiring compartments plus hook-on hinges, and are available in a wide variety of light control and diffusion mediums. Data sheet is available.

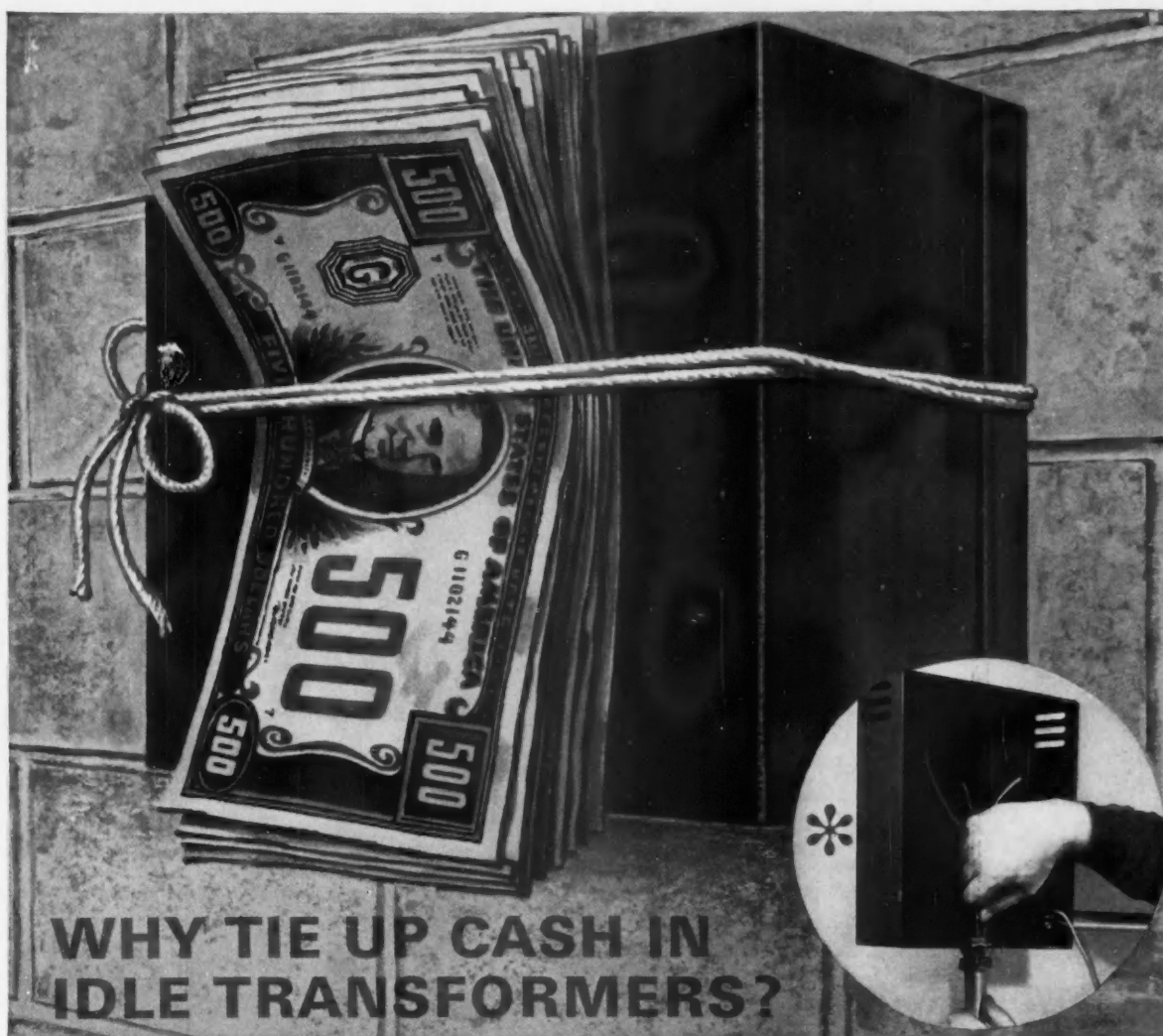
Sunbeam Lighting Co., 777 East 14th Place, Los Angeles 21, Calif.

### Plastic Guards (21)

New outlet box plastic guards have been announced. They come in assorted sizes to fit every outlet box. The flexible marker makes the box easy to locate even though the box and guard are completely covered with plaster. Guards are made of polyethylene.

Plas-Tec Co., Inc., Sherman Oaks, Calif.





## WHY TIE UP CASH IN IDLE TRANSFORMERS?

Allis-Chalmers separate rear panel lets you complete all system wiring fast! And you purchase transformers only when construction nears completion

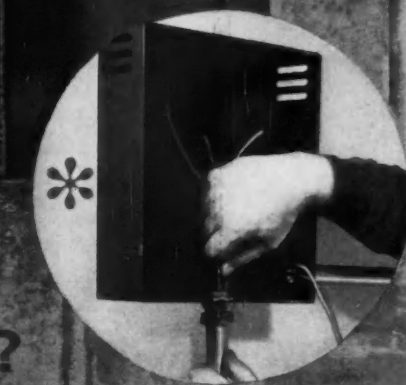
You save BIG with A-C 3-piece transformers! Need to install 20 dry-type units, for example? Pick up just the rear panels from your A-C distributor. Mount 'em and complete your conduit work. Ninety per cent of your installing job is done. Use the panels as temporary junction boxes if you wish.

Weeks later, pick up the transformer section and cover plate for each A-C unit. In less than 10 minutes per unit, you'll finish the job. And you've kept the transformers out of the general construction dirt.

Most important, you don't tie up your money in *complete-unit* dry-type transformers for weeks at a time. All you need initially is the back mounting panel if it's an Allis-Chalmers *exclusive 3-piece case unit!*

Available only from A-C, these 3-piece case, dry-type, ventilated transformers (600-volt class, indoor) are offered in 10 sizes, from 3 to 45 kva. Call your nearby A-C office for free Bulletin No. 61B8222C or write Allis-Chalmers, Box 512, Milwaukee 1, Wis.

A-1663



Rear mounting panel

Center transformer section anchors to rear panel after all conduit work is completed.

Front cover

# ALLIS-CHALMERS



NO. 3434

## SUPER

# Twist-Lock

### FLANGED POWER INLETS AND OUTLETS

**LEFT:** No. 3434 Super "Twist-Lock" 4-wire flanged power inlet for 30 amperes, 250 volts AC-DC, or 30 amperes, 600 volts AC.

**BELOW:** Yellow represents cross-section of standard sized 20 ampere, 4-wire flanged power inlet for 250 volts AC-DC, or 10 amperes, 600 volts AC. Note how much smaller No. 3434 Super "Twist-Lock" unit is, even though rated 10 amperes greater.

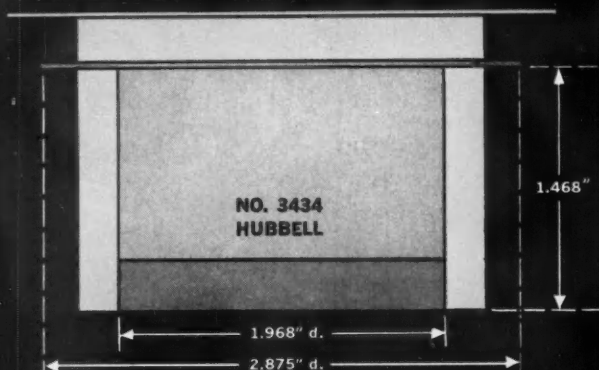


DIAGRAM ACTUAL SIZE  
YELLOW IS STANDARD SIZE;  
SUPERIMPOSED IS SUPER "TWIST-LOCK" SIZE



## NOW—POWER INLETS AND OUTLETS IN SPACE-SAVING DIMENSIONS

### Super "Twist-Lock" Devices Handle Higher Amperages in Less Space

When a matching connector is plugged into a Super "Twist-Lock" inlet or outlet, a clockwise twist locks it against accidental disconnection. Dead-front construction seals out dust, lint, metal chips, etc.

Super "Twist-Lock" devices are much more compact and lighter in weight than standard models. Designers of machines and power tools specify them because they gang closely and reduce wiring time.

Super "Twist-Lock" flanged inlets and outlets in polarized grounding or ungrounded models are available in 10-, 20-, and 30-ampere ratings for 2-, 3-, 4-, or 5-wire circuits.

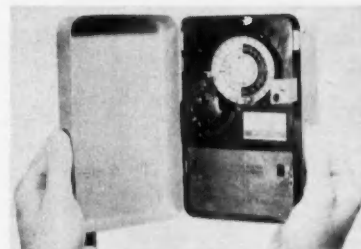
Super "Twist-Lock" inlets, outlets, cord caps, connector bodies, and receptacles are described in our Catalog No. 29. Or write for 24-page brochure H-1425 on the "Twist-Lock" line.



**HARVEY  
HUBBELL  
INCORPORATED**

Bridgeport 2 Connecticut

® "Twist-Lock" is a registered trademark of Harvey Hubbell, Incorporated



### Time Switches (22)

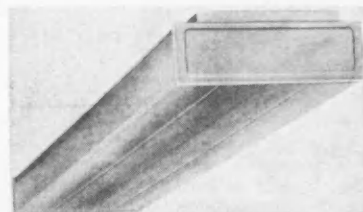
Three new time switches with 40-amp contact rating have been announced. Features available within the line are UL listed rain-tight cases, models for operation on line frequencies of 60, 50 and 25 cycles, and both single pole and double pole models.

General Electric Co., Schenectady 5, N. Y.

### Drill (23)

A nickel-cadmium battery-powered heavy-duty drill has been announced. It is a 3-in. portable drill that operates from a separate, 12-volt rechargeable battery pack that clips to the user's belt. It can be used in wet or damp areas. Charger permits overnight recharging of battery when connected to any 115-volt outlet. On a single battery charge, it can drill up to 100 3/4 in. holes in dressed 2-in. fir lumber, over 100 1/4 in. holes in 16-gauge steel and more than 4,000 1/4 in. holes in 1/2 in. tempered Masonite. "Power-Pack" is an Eveready battery unit.

Skil Corp., 5033 Elson Ave., Chicago 30, Ill.



### Reflector (24)

The Quentin II is an improved design "wrap-around" shielded line of fixtures. End caps are attached to plastic shielding for hanging and removal. A new 16-in. width for four lamps has been added. Available in prismatic shielding for low brightness and high efficiency and in smooth white diffuse plastic shielding.

Wheeler Reflector Co., Inc., Hants, Mass.

# CRESCENT

## HYVOLT SHIELDED POWER CABLE

*Gives More Amperes  
Per Dollar  
of Installed Cost*

NEOPRENE SHEATH

RUBBER-FILLED TAPE

METAL SHIELDING TAPE

SEMI-CONDUCTING TAPE

HYVOLT INSULATION

CONDUCTOR SHIELDING TAPE

CONDUCTORS

### LOOK AT THESE ADVANTAGES

1. Long life.
2. Can be operated at 85°C. Permits smaller conductors or more amperes per conductor.
3. Freedom from corona cutting.
4. Excellent resistance to moisture.
5. Low power factor and dielectric loss.
6. Lighter, more flexible, easier to handle and install than lead covered cables.
7. Electrolytic or chemical corrosion of lead sheath is eliminated by use of neoprene sheath.
8. Shielding prevents possibility of surface burning and provides safety to human life.



**CRESCENT INSULATED WIRE & CABLE CO., INC.**

**TRENTON, NEW JERSEY**

CRESCENT HYVOLT insulation is made from butyl rubber which is inherently resistant to ozone, heat, moisture and aging. HYVOLT is formulated and processed so as to retain these inherent characteristics of the butyl rubber and at the same time provide excellent electrical and physical properties.

The insulation is protected during and after installation by an outer neoprene sheath providing a maximum degree of toughness, durability and long life. It is flame retarding and resistant to the deteriorating effects of moisture, sunlight, ozone (corona), oil, grease, and many acids and alkalis.

HYVOLT Shielding provides additional internal and external protection in these **THREE WAYS**

- 1 Conductor shielding, as provided by a semi-conducting tape over the stranded conductors, excludes air pockets between conductor and insulation and eliminates possible internal corona-cutting of the insulation.
- 2 The semi-conducting tape between the insulation and metallic shielding tape prevents possible ionization of air spaces and corona at the insulation surface.
- 3 The metallic shielding tape is grounded when installed, resulting in zero potential to ground at the sheath. It prevents surface discharge or burning, and protects cable from lightning surges. Reduces shock hazard.

### RECOMMENDATIONS

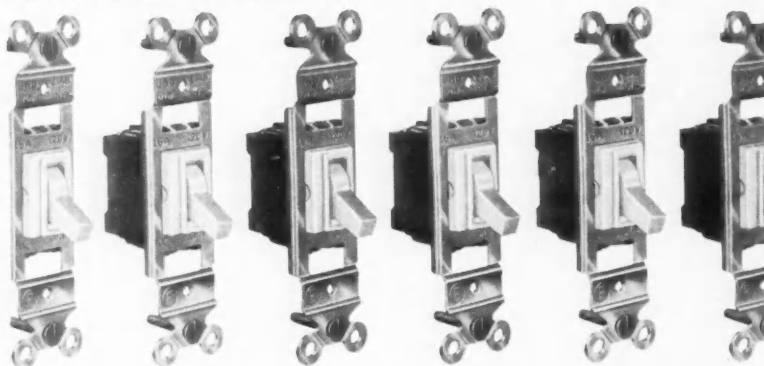
CRESCENT SHIELDED HYVOLT CABLE is recommended for use in conduits, underground ducts, in wet or dry locations, or buried directly in the ground, for circuits operated at over 3000 volts and in accordance with I.P.C.E.A. recommendations. Available in single conductor or multi-conductor cables.

Specify CRESCENT SHIELDED HYVOLT POWER CABLE for general power circuits and where severe conditions are prevalent such as chemical plants, refineries, paper mills, mines, sewage disposal plants, etc. It is approved as Airport Lighting Cable Type B, CAA Specification L-824.



# THE QUIET SWITCH THAT RUNS CIRCLES AROUND ALL OTHERS

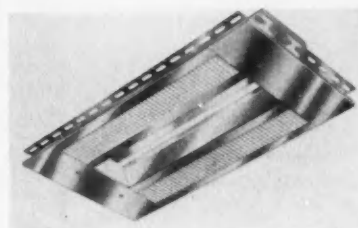
# COMPARE THEM!



## COMPARE **CIRCLE F NO-KLIK JUNIOR®** QUIET SWITCHES WITH ALL OTHERS! WHAT'S THE DIFFERENCE?

Circle F's NO-KLIK JUNIOR is a q-u-i-e-t—almost silent—operating switch without mercury or other fluids at a *new, low price!* It's rugged, not down rated and means more profits for you. And there are *more differences!* Large, silver alloy contacts assure long life under continuous, heavy duty service. Raised cover fits snugly and keeps dust out. Washer type ears are scored for easiest removal. Large No. 8 binding head screws with cut slots takes any wire size up to No. 10. Enclosed in moulded Bakelite body. Listed with UL and CSA.

**CIRCLE F MFG. CO. TRENTON 4, N. J.**



## Heating Unit (25)

A new electric infrared comfort heating unit is designed specifically for recessed mounting. Ideal for store fronts, canopies, theater marquees—anywhere a flush mounting is desirable—the new heaters can be furnished with plaster frame, finish-trim rings and special lay-ins. Either T-3 quartz lamps or quartz tubes can be utilized in the units, which can be operated at 120, 208, 240 or 480 volts. Unit capacity ranges from 550 to 4000 watts.

*Fostoria Corp., 1200 N. Main St., Fostoria, Ohio*

## Wall Plates (26)

A new series of wall plates for residential, commercial and industrial use has been introduced. Available in both metal and plastic, they meet all NEC and Federal requirements and are listed by UL. Metal series consists of 22 basic types, each in five different materials: brass with satin finish; aluminum with satin finish; brass anodized aluminum; stainless steel; and white enameled steel.

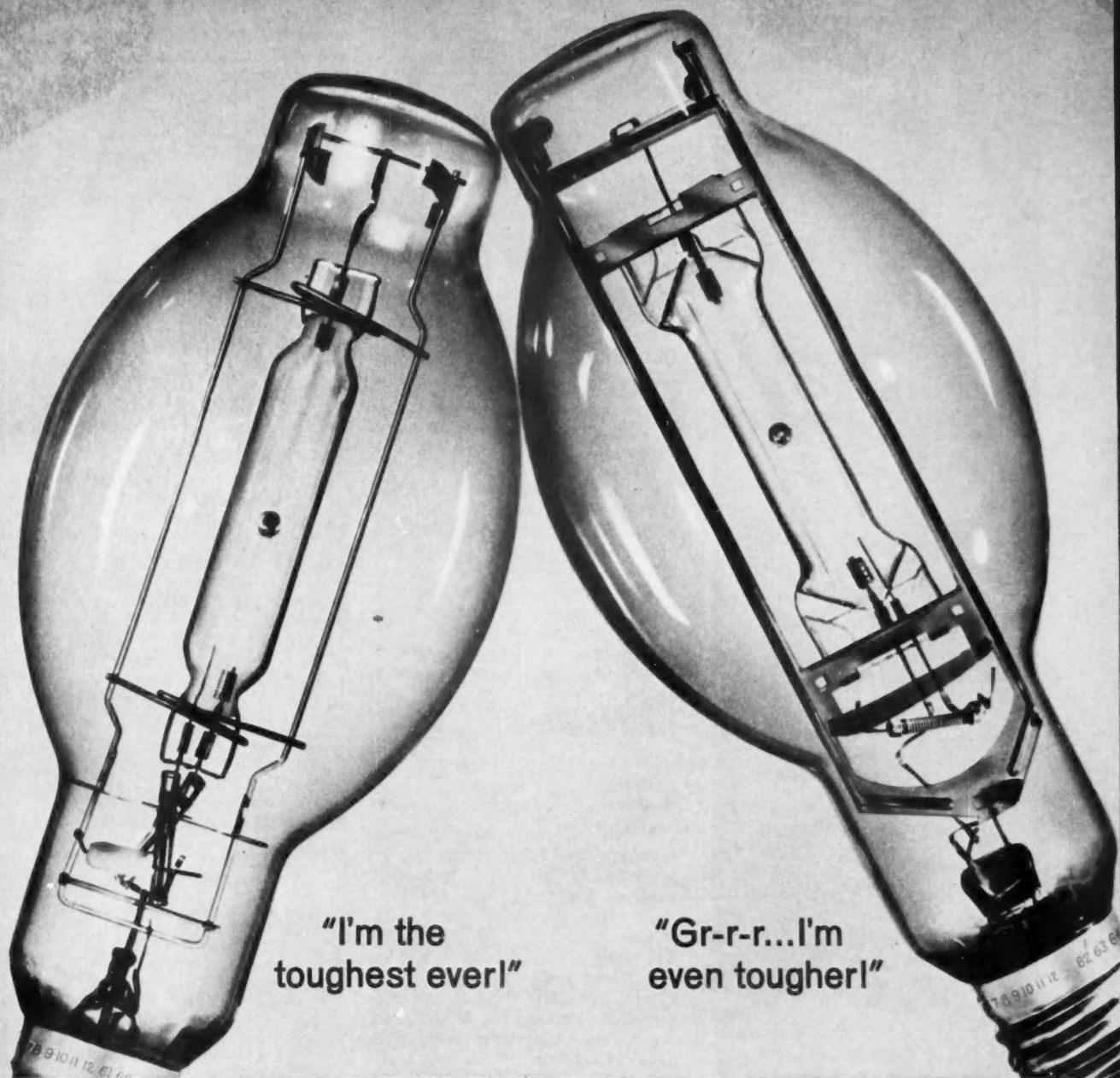
*Leviton Manufacturing Co., Inc., 236 Greenpoint Ave., Brooklyn 22, N. Y.*

## Terminal Blocks (27)

Sectional terminal blocks are available in three sizes covering a wire range from No. 22 through 250 MCM. The "Pres-sure-block" design has been extended from the original MD (medium duty) size, for wires from No. 22 through No. 8, to cover two more size ranges. The HD (heavy duty) size accepts wires from one No. 14 through one No. 4 and the XHD (extra heavy duty) takes from one No. 4 through 250 MCM. Blocks are supplied in preassembled lengths from which any number of contact sections are snapped off and completed with an end section for the block size desired. A choice of tubular and strap-type contacts adapts the entire line to either stripped or terminal-ended wires.

*Buchanan Electrical Products Corp., Hillside, N. J.*





"I'm the toughest ever!"

"Gr-r-r...I'm even tougher!"

## World's toughest mercury lamp gets new unbreakable backbone!

**New one-piece steel frame makes Sylvania Rough Service Mercury Lamp the toughest, longest-lasting, most vibration-proof mercury lamp ever built. Meet the undisputed champion!**

Until now mercury lamps burned with the ever-present danger of a frame weld breaking.

But now Sylvania brings you a frame that is one solid piece of nickel-plated steel—ounce for ounce as tough as a steel girder. Cannot break. And where an arc tube was once suspended with welded pieces, this new frame actually *clamps* it in place. *Firmly* on all sides. *Exactly* in position to give the most light.

The heat shield, too, is part of this one-piece frame. And the double leaf spring supports are reinforced to make sure the frame stays in place. With all this, you still get unsurpassed Sylvania lumen output. Plus ruggedized hard glass shell. Plus Sylvania's convenient lifetime recording base. Plus Sylvania's

exclusive Certified Performance Policy.\* Sylvania Rough Service Mercury Lamps are already available in the 400-watt size and at regular prices!

See your representative—or write: Lighting Division, Sylvania Electric Products Inc., Dept. 15, 60 Boston Street, Salem, Mass.

\*Certified performance policy guarantees: "Sylvania Mercury Lamps may be returned to the supplier for full exchange if they fail in less than 1000 burning hours, and thereafter (up to 5000 hours) for pro-rata exchange, in accordance with a pro-rata exchange value table set forth clearly in the policy form."

# SYLVANIA

SUBSIDIARY OF  
GENERAL TELEPHONE & ELECTRONICS

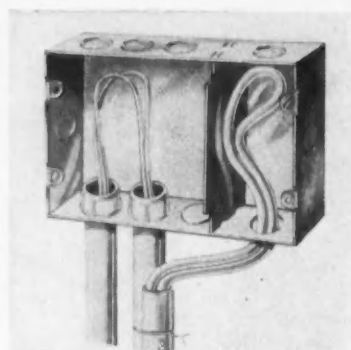


# You have to go a long way... to match "EAGLE" quality!

A long way, indeed! For 42 years, Eagle Electric has manufactured electrical wiring devices designed to cut installation time, to lower costs, and to meet the most rigid specifications of QUALITY at fair prices.

Eagle places so much importance on QUALITY that special inspectors are employed to inspect the inspections of customary inspectors. This is a mammoth operation, when you consider that there are more than 1500 different items in the full Eagle line—a long, broad line by any standards.

You have to go a long way to match Eagle QUALITY... at any price.



**Outlet Box (28)**

A 2-gang telephone and electric box for installation in new fireproof buildings where prewired telephone outlets have been specified, has been developed. The design allows installation of both electrical outlet and telephone outlet in one box. Both sections are separated by a metal barrier, or low-voltage partition. The barrier is in an off-center position, giving the electrical section enough room to include three  $\frac{1}{2}$  in. knockouts in both top and bottom of box. A special adapter cover has been designed to fit the box.

Arrow Conduit & Fittings Corp.,  
180-20 180th St., Jamaica 33, N. Y.

**Heater (29)**

A new infrared heater designed especially for comfort heating of employees working in drive-in bank windows and other exposed locations where glass and metal cause serious heat loss and discomfort. The TCB heater directs a blanket of infrared radiation over the area to be heated. Unit is equipped with a variable heat control so that user can regulate his own comfort with a dial adjustment. Basic unit is designed for 110-volt operation and has a capacity of 1500 watts. Units for 220-volt operation and other wattages are available on special order.

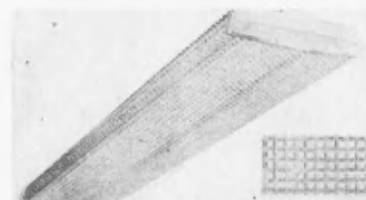
Sun-Heat, Inc., 990 E. Woodbridge Ave., Detroit 7, Mich.

**Terminal Blocks (30)**

A new line of single-pole, channel-mounted terminal blocks for control circuit applications has been introduced. Termed Bulletin 1492 Style C, the new blocks come in four versions: Style CA non-fusible, for No. 22 to 8 wire; Style CA fusible, for No. 16 to 10 wire; Style CB, for No. 16 to 4 wire; and Style CC for

wires No. 6 to 1/0. Maximum rating of all four versions is 600 volts. Style CA fusible block holds any single fuse having a cartridge that is  $\frac{3}{8}$  in. in dia and  $1\frac{1}{2}$  in. long, or any double fuse in which one of the cartridges has those dimensions.

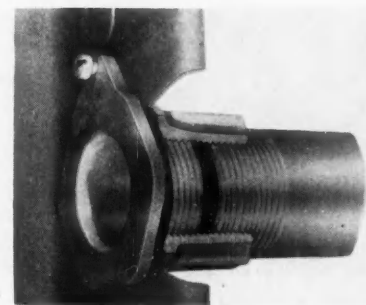
Allen-Bradley Co., 102-1 West Greenfield Ave., Milwaukee 4, Wis.



**Luminaire (31)**

A new fluorescent luminaire with self-cooling action, called Prismaround, has been announced. It features improved Prismoid louvers that consists of hundreds of open  $\frac{1}{8}$ -in. prisms that "breathe" to allow air to circulate freely. Units are available in 2- or 4-light widths. Prismaround baskets are furnished in 4-ft lengths. Channels are one-piece 4 or 8 ft. Baskets can be hinged from either side for relamping. Units are constructed of heavy-gauge, 6-stage zinc-phosphatized steel and finished in Acrylic white.

Edwin F. Guth Co., 2615 Washington Blvd., Box 7079, St. Louis 77, Mo.

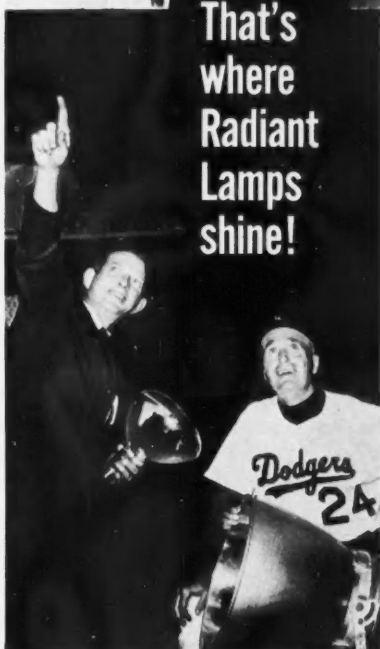


**Hubs (32)**

A new line of Rigid-Conduit hubs featuring liquid-tight seal, positive ground and increased wiring space within the enclosure, are now available. The Spin-Tite hub made of cast aluminum alloy has a new design for all standard knockout sizes  $\frac{1}{2}$  in. to 4 in. and is suitable for enclosures from  $\frac{1}{8}$  in. to  $\frac{3}{4}$  in. wall thickness. Bulletin No. 862 is available.

The M. & W. Electric Mfg. Co., Inc., East Palestine, Ohio

**CHAVEZ RAVINE . . . THE NEW  
LOS ANGELES DODGER STADIUM**



**That's  
where  
Radiant  
Lamps  
shine!**

**WHEREVER LIGHTING SPECIFICATIONS  
ARE OUT-OF-THE-ORDINARY . . .**

Radiant comes thru! Like with this first reflector incandescent lamp ever to illuminate a major league ball park! Designed, researched, tested and manufactured by Radiant, this efficient lamp provides high concentration of light on the playing field with amazing control of glare for spectators and players. Low cost installation. Extra long-life performance, too.

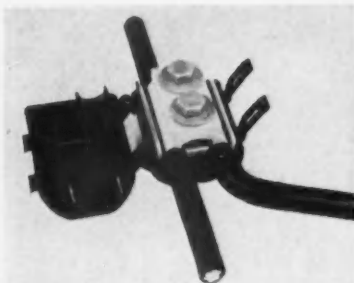
lighting by Homel fixtures by Shaldo

For information, examples and suggestions on effective indoor and outdoor lighting, write or call Les Deutsch (Bigelow 3-6850) for your copy of our Radiant Catalog.



**RADIANT  
LAMP CORPORATION**

DAVID A. FOXMAN, President  
300 Jelliff Avenue, Newark 8, New Jersey



**Connector**

**(33)**

A triplex-transformer tap connector has been introduced. It was developed to combine the electrical properties of a specially designed parallel groove clamp with a high dielectric strength polyethylene insulating cover to form a completely insulated connector. One of the features is the tangential plate which receives the bolt clamping pressure and redistributes it uniformly over the arc of the clamping cap.

Dossert Manufacturing Corp.,  
249 Huron St., Brooklyn, N. Y.

**Benders**

**(34)**

Two new hydraulic bender sets, each designed for one-shot bending of conduit or pipe, have been introduced. The new EnerPac benders feature a newly developed high-speed hand pump. Units are designated as Models S-137B and S-144B. Model S-137B bends 1½-in. through 3-in. pipe or conduit in one shot; also bends 3½-in. and 4-in. sizes segmentally. Model S-144B is similar to S-137B, but includes an attachment that permits one-shot bending of all sizes, 1½ in. through 4 in.

Blackhawk Industrial Products  
Co., Butler, Wis.

**Television Equipment**

**(35)**

A new line of closed-circuit television equipment, consisting of three transistorized cameras and a monitor, has been introduced. This line is designed to meet any specific use of closed-circuit television. It consists of all-weather, indoor and explosion-proof cameras. All three units are equipped with special light compensation circuitry which automatically adjusts camera sensitivity to light conditions. Cameras also have an electronic regulator to hold pictures in focus despite fluctuations in line voltage and ambient temperatures.

Motorola Inc., Communications  
Div., 4501 West Augusta Blvd., Chi-  
cago 51, Ill.



**... for example:**

The only competitively priced quiet switch with both screw and E-Z wire pressure terminals.

**SPECIFICATION GRADE**

- Simple construction—few moving parts to get out of order.
- Famous Eagle patented ball construction delivers both fast make and slow break.
- Automatic fool-proof mechanical action.
- Extra common terminal connections for continuous wiring.
- Silver contacts for durability.
- Speeds installations—eliminates call backs.
- 15 amps—120 volts AC. Single pole (#1021), Three Way (#1023). Underwriters' Listed. Meets Federal Specifications.

**MEETS BOTH LOW-BUDGET AND  
PREMIUM QUALITY REQUIREMENTS**

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**EAGLE ELECTRIC MFG. CO., INC.**

23-10 BRIDGE PLAZA SOUTH, LONG ISLAND CITY 1, N. Y.

"Perfection Is Not an Accident"



FOR YOU  
WHO  
WANT  
THE  
BEST



**CHAN NEL LOCK**

Surgical instrument quality at no extra cost . . . yours with Channellock. Drop forged of highest grade steel. Precision machined jaws. Hand-honed cutting edges. Full polished finish. A full line of standard and special styles to choose from. For you who want the best, your choice of pliers—as with thousands of craftsmen—will be Channellock.

*A copy of our catalog showing the complete Channellock Plier line is yours for the asking. Write to: Champion DeArment Tool Company, Meadville, Pennsylvania.*



**Floodlight (36)**

A new explosion-proof 500-watt quartz-iodine floodlight for use primarily in Class I, Group B hazardous locations containing hydrogen, has been introduced. The floodlight, identified as Type FEQ, is weather resistant and raintight, has heat and impact resistant plate glass face, universal adjustment, reflector design and compact size. The permanent mounting base has three  $\frac{1}{2}$  in. hubs, two of which are furnished plugged.

*Pyle-National Co., 1334 N. Kostner Ave., Chicago 51, Ill.*



**Switch (37)**

A new submersible switch for low-voltage networks has been introduced. Rated at 1200 amps, the 600-volt ac, 3-phase switch can be operated under load. Equipment is designed so that door can hinge left or right, to provide accessibility in confined manholes. Equipped with stainless steel operating shaft, switch contains cast wiping sleeves for two 500 MCM lead covered cables for each phase and a Belknap pressurizing valve.

*Richardson-AlLEN, Div., Kollsman Instrument Corp., 116-15 15th Ave., College Point, N. Y.*





## Now... 11 J-M Dutch Brand® electrical tapes are available in the best dispenser in the business!

Now you can have the finest plastic electrical tape in the industry, packaged in the handiest tape-and-tear dispenser tool ever designed! Johns-Manville Dutch Brand Dispensers make any electrical job quicker. A special "grip strip" makes for fast, easy starting... saves time! What's more, you can choose from 11 different electrical tapes to fit your particular job. Here they are:

- Black plastic electrical tape in standard 66' rolls.
- Black plastic electrical tape "job size" 44' rolls.
- Special Cold-Weather plastic electrical tape in standard 60' rolls.

- Vinyl tape in eight colors, for color coding, job identification—in red, green, orange, blue, yellow, brown, silver and white—available in 66' rolls.

Look at all the important advantages you get with this new dispenser tool—permanently shielded cutter... no moving parts to snag hands, clothes... can't clog... "tape and tear" with one hand... contains the finest plastic electrical tape made... pre-loaded,

ready to use... protects tape against dirt, grease... big center hole for easier handling... re-usable!

These J-M Dutch Brand tape-and-tear dispenser units can help you do your job with less effort and more economy! Get the full story from your Dutch Brand Distributor. Or write Johns-Manville, Box 359, New York 16, N.Y. In Canada: Port Credit, Ont. Cable: Johnmanvil.



**JOHNS-MANVILLE**  
DUTCH BRAND TAPE



# "Hi-RED" PLASTIC EXPANDING SCREW ANCHORS



**SAVE UP TO 70%**  
**USE IN ANY MATERIAL YOU CAN DRILL: CONCRETE, STONE, CINDER BLOCK, BRICK, MORTAR, TILE, ETC.**

## MILLIONS IN USE!

(A REAL JOB-PROVEN ANCHOR)



"Hi-RED" anchors may be cut as needed for short screws

- Anchor costs less.
- Costs less to install — takes smaller hole ... no tamping.
- Terrific holding power (P.T.L. ratings up to 4,180 lbs.)
- Sizes up to 1/2" lag screw.



... and used in tandem with long screws.

**BUY 'EM IN BULK OR KITS!**

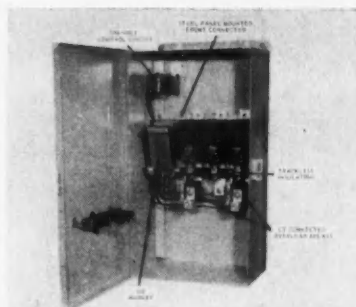
**FREE SAMPLES**

**SEND "Hi-RED" SAMPLES**

NAME \_\_\_\_\_  
FIRM \_\_\_\_\_  
STREET \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_



**HOLUB INDUSTRIES, Inc.**  
442 ELM ST. • SYCAMORE, ILL.



## Starters (38)

New line of low-voltage, heavy duty starters, Size 4 through 9, 600-volt, has been announced. All sizes utilize a dc magnet. Standard in the line is 110-volt control. It is provided through a control transformer with 220/440 or 550-volt primary and 110-volt fused secondary. Front-connected low-voltage control is a space-saver. Sizes 7, 8 and 9 continue to utilize rear connections.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

## Instrument (39)

A new "Twin-Pack" recorder kit, consisting of a recording voltmeter and ammeter packed together in a leather carrying case, has been announced. The kit, which is designated as ATM-2, contains two miniature recorders: a recording voltmeter, Model AV1X, and a snap-on type recording ammeter, Model AA2. The voltmeter has an expanded scale which covers the ranges of 95-130 and 190-260 VAC. The ammeter's ranges are 0-5/25/100/250 amps ac. Tape speed on both models is 12 in. per hour. Instruments operate independently of each other.

Amprobe Instrument Corp., 630 Merrick Road, Lynbrook, N. Y.

## Drill (40)

A new model core drill featuring a specially designed Black and Decker motor has been announced. Motor switch has a built-in thermal overload protector that automatically shuts off motor when subjected to prolonged overloading or improper voltage. Model D-10 is for drilling holes up to 6 1/4 in. in dia through reinforced concrete, masonry, stone and refractories. Other features include ceiling support, built-in water swivel and cast iron base.

Clipper Manufacturing Co., 2800 Warwick, Kansas City 8, Mo.

## Nurses' Call System (41)

A new audio-visual nurses' call system, designated as Series 4000, has been introduced. Features are remote supervision, dialset, priority, and privacy. Another feature is the availability of other service facilities, in addition to the nurses' call, at each patient's bedside, if desired. In one enclosure and in modular form so that only those facilities desired may be selected, provision is made for the connection of any or all the following: 110-volt convenience receptacle, TV, radio, TV and radio, oxygen, vacuum, telephone, light switch, night-light, etc.

Auth Electric Co., Long Island City 1, N. Y.

## Heater (42)

A swimming pool heater with the heat pump principle. Named Wesco fuel-less pool heater, unit takes heat from the air and transfers it to the water. Electricity is used only to operate the compressor motor. Units are made in two models delivering 11,000 and 18,000 degree feet. They are designed to tie into existing or new installations.

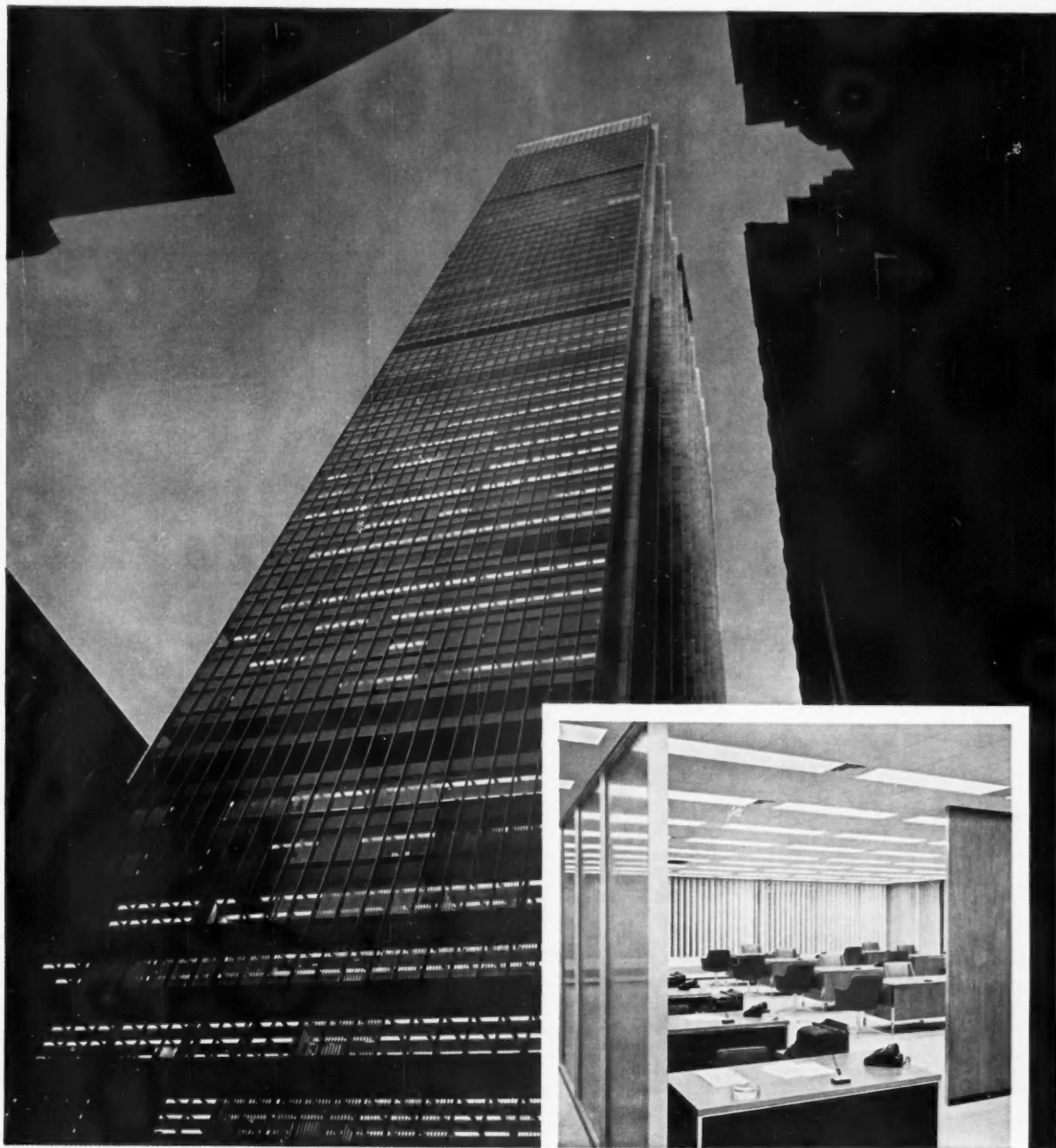
Wesco Furnace Division, Northwest Foundry & Furnace Co., Portland, Ore.



## Terminals (43)

Announcement has been made of a new innovation in carbon brush terminals that enables a rapid change of brushes while equipment is operating. Called the H Q D (Helwig Quick Disconnect) terminal, the new design solves the problem of speedy brush replacement in running equipment. They provide positive contact as well as safe electrical connection. Mounting is easily adapted to any bolt attachment presently used.

Helwig Carbon Products Inc., 2550 N. 30th St., Milwaukee 10, Wis.



Architects: Skidmore, Owings & Merrill

## *Lighting* for prestige buildings— **Plexiglas**

There are 40,000 fluorescent luminaires, each equipped with a lens molded of crystal-clear PLEXIGLAS® acrylic plastic, at the new Chase Manhattan Bank building in New York—a landmark on the downtown skyline and a milestone in architectural planning.

The PLEXIGLAS lenses are precisely designed optical elements that assure full utilization of light. They are strong and rigid, yet light in weight . . . will remain free of discoloration after years of exposure to fluorescent light. The result: another example of a magnificent building that uses PLEXIGLAS to obtain lighting of the highest quality.

We will be pleased to send you literature on PLEXIGLAS

as a lighting material, and the names of manufacturers whose equipment includes PLEXIGLAS lenses and diffusers . . . for lighting that stands out and stands up.

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&  
HAAS**

PHILADELPHIA 5, PA.



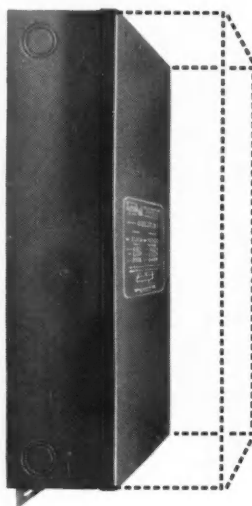
In Canada: Rohm & Haas Co. of Canada, Ltd., West Hill, Ontario

# NEW!

## SOLA "MERC-MITE" MERCURY BALLASTS

# CONSTANT-WATTAGE PROTECTION AT 20% SAVINGS!

space  
miser  
silhouette



50%  
smaller  
in size!

The ultra-compact Sola "Merc-Mite" constant-wattage ballast introduces advantages actually comparable to premium constant-wattage types, in a revolutionary new autotransformer design. SIZE — FULLY 50% SMALLER! PRICE — 20% LOWER! Sola Merc-Mite CW ballasts leave old ideas far behind . . . offer you this powerhouse of special advantages: Control inrush to lamp; do away with any need for time delay fuses; allow savings in wiring, since there's no severe starting surge; permit more lamps per circuit; forestall troublesome drop-out. Sola Merc-Mite ballasts are presently available in 400-watt single-lamp type. For more information and prices on models, write to us direct.



1717 Busse Road  
Elk Grove Village, Ill.  
HEmpstead 9-2800

IN CANADA:  
Sola-Basic Products Ltd.  
377 Evans Ave.  
Toronto 18, Ontario

S-4-63





#### Electric Heat (44)

The Minivector is a baseboard mounted convector in a fully enclosed cabinet. Available in six sizes, with either integral or wall-mounted thermostat controls, the convector may be fully recessed, semi-recessed, flush mounted, or free standing installations in front of wall-to-ceiling windows. The UL-listed convector contains a stainless-steel element. Cabinet has shadow-box styling and a beige finish. It is 11 in. high and 3½ in. deep. Convector lengths run from 28 in. to 8 ft and are rated at from 500 to 2000 watts. They are designed for operation at 120, 208 or 240 volts.

*Spartan Electric Radiator Corp., 1500 W. Blancke St., Linden, N. J.*

#### Integrated Ceiling System (45)

A complete new concept in ceiling design for the construction industry, known as Colamar Mark-50 integrated ceiling system, is now available. System is designed to control the environmental elements of a building interior — light, sound, air diffusion — from one modular source. Each module contains a combination lighting fixture and air diffuser, acoustical tile, ceiling joinery and provisions for movable partitions. Standard square modules in sizes of 4 ft 4 in., 4 ft 6 in., 5 ft and 6 ft are available. An air-handling lighting fixture which is part of the system comes in either a 1- by 4-ft or a 2- by 4-ft size.

*Westinghouse Lighting Division, Westinghouse Electric Corp., Edgewater Park, Cleveland, Ohio*

#### Scaffold (46)

The Baker Tele-Scaf, a telescoping scaffold, is available in three models with working heights from 6 ft 8 in. It is cable-controlled, either powered or manually operated. Units are designed for safety and incorporate "fail-safe" features as well as out-riggers and stabilizers. Units are portable, equipped with casters, and will pass through standard size doors, and stores in a minimum area.

*Baker-Roos, Inc., P. O. Box 892, 602 W. McCarty St., Indianapolis 6, Ind.*

#### Spotlight (47)

A new 300-watt standard spotlight fixture with open ventilation port in back, for use with the new GE 300PAR/2 cool beam lamp—narrow spot, medium and wide flood—is available. The coated reflector in lamp transmits heat to rear, resulting in a reduction in the radiant heat of the spotlighting beams. With use of fixture and cool beam lamp, lighting on displays can be increased without increasing surface temperature or the present amount of lighting can be used with a decrease in surface temperature. All types of mounting are available in the 300-watt fixtures.

*Lighting Services, Inc., 77 Park Ave., New York 16, N. Y.*

#### Lighting Fixture (48)

New explosion-proof lighting fixtures, the LA Series, are for use primarily in Class I, Group B locations containing hydrogen but may also be used in less hazardous Group C and D areas. Fixtures are of pendant type tapped for ½-in. conduit and are furnished plain or with a choice of dome, deep bowl, shallow or 30° angle reflectors for 150-200-watt or 200-300-watt incandescent lamps. Concentric slip rings that wipe contacts on the line terminal block permit removal of reflector, guard and globe as a unit for lamp changing and cleaning.

*Pyle-National Co., 1334 N. Kostner Ave., Chicago 51, Ill.*

#### Ladders (49)

New hydraulic powered aerial ladders have an operating range from 7° below horizontal to 70° of elevation with continuous 360° rotation. Both Model LHE, with separate air-cooled engine contained in the ladder mast, and Model LHP, which is driven by a power take off, are available with a choice of three top controls and two lower controls. They are for use in street light changing, line work, cable maintenance and most overhead jobs. Ladders equipped with top controls enable the operator to lower himself directly to the ground. Ladder framework can be mounted on any service type or open bed body and incorporates steps for access to lower ladder section. They are available in platform-to-ground heights of 24, 28, 32 and 36 ft.

*Utility Body Co., 1530 Wood St., Oakland, Calif.*

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# TIMER

to reduce  
operating costs  
by automating:

SEWAGE TREATMENT • CHEMICAL FEED  
ACCESS PURGING • MACHINE TOOLING  
WATER SOFTENING • AREA SPRINKLING  
TRAFFIC SIGNALS • BATTERY CHARGING  
SEWAGE AERATION • MOTOR CONTROL  
HEAT TREATING • LIFE TESTING  
LUBRICATION • IRRIGATION  
WATER PUMP TIMING  
GREENHOUSE MISTING  
AIR CONDITIONING  
PROCESS TIMING  
VENTILATING  
CONVEYORS  
HEATING  
MIXING



516 Series



500 Series



2000 Series



JW Series



CR Series



1015 Series

# PARAGON

makes it!

No matter what the application, you can rely on high quality Paragon Time Controls to automatically control the "ON-OFF" operations.

For complete specifications and application data contact your Authorized Paragon Distributor. He carries a full line in stock and is qualified to provide technical assistance if needed.

Call for Paragon  
on your next order.

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WHOLESALE POLICY**  
We sell Paragon Time Controls to dealers, contractors and industrial and users ONLY through our established Wholesalers. Paragon does not depart, under any circumstances, from this policy—fully held for more than 30 years.



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Soleholders of American Machines & Foundry Company  
1014 TWELFTH STREET • TWO RIVERS, WISCONSIN

*Time is money... control it with Paragon*

## Tape

(50)

A new arc and fire protection tape for prevention of damage to electrical and communications cables in manholes, cable trays, switch boxes and substations, has been introduced. Called "Irvington" brand arc-proofing tape No. 7700, it is made of a lightweight, heat resistant organic fabric coated on one side with a specially formulated flame retardant elastomer. The extra margin of protection provided by the new material provides a longer impulse time for automatic cut-off equipment to function.

*Irvington Div., Minnesota Mining and Manufacturing Co., St. Paul, Minn.*

## Electric Heating

(51)

A new convection baseboard, known as "Heatliner" series, features a new mounting structure on the heat exchanger which glides on rails for silent expansion and contraction. Units will be marketed in lengths of 4, 6, 8 and 10 ft. Rod-type elements connect with built-in prewiring for simple installation. Also the Heatmaster, a deluxe series, will be introduced. Both Heatliner and Heatmaster convection baseboard lines meet the new NEMA and UL requirements.

*Hunter Division, Robbins & Myers, Inc., 2500 Frisco Ave., Memphis 14, Tenn.*

## Silicone Rubber

(52)

A new room-temperature-curing silicone rubber for encapsulating random-wound motors by the buttering method is available. Designated Silastic RTV S-5361, this material is designed specifically for application to stator windings by spreading with a knife, spatula or tongue depressor. Once cured, the encapsulant provides protection from moisture, dirt, abrasives, vibration and many chemicals. Useful operating range of the insulation, suitable for Class A, B or F motors, is minus 70 to 180 C. Material is available in 1-lb and 10-lb cans.

*Dow Corning Corp., Midland, Mich.*

## Connector

(53)

A multiple tie transformer connector allows two or more cable connections to be made at a single transformer terminal. Designated

Type MTR-C, the connector is a solidly bonded unit of pure copper, electro-tin plated to minimize corrosion. It features a contact stud for terminal connection and a flag type pad NEMA drilled to receive two or a number of compatible terminals, lugs, or connectors. The multiple tie connector with its four or more contact pad holes simplifies connection of additional cables.

*Dossert Mfg. Corp., 249 Huron St., Brooklyn, N. Y.*

## Product Briefs

(54) Anaconda Wire and Cable Co., Hastings-on-Hudson, N. Y., has introduced a new **splice kit**, designed for on-the-job repairs of various types of mining cable. . . .

(55) Flexible **plastic caps** for on-the-job protection of conduit and pipe installations against dirt, water and other foreign matter are now available from Protector Products, Inc., Cleveland, Ohio.

(56) Swan Mfg. Co., Vancouver, Wash., is now manufacturing a new combination **thermostat** which controls both heating and cooling, called the "Climate-stat." . . .

(57) Outdoor high-voltage butyl-molded current **transformers** in 5 and 8.7 kv (Types CTOM-5 and CTOM-8.7) are now available from the Distribution Transformer Div., Westinghouse Electric Corp., Sharon, Pa.

(58) Lima Electric Motor Co., Inc., Lima, Ohio, has announced two new broader lines of brushless, revolving field, ac synchronous **generators** with inherent voltage regulation, Type GPA (general purpose application) and Type MAC (motor application characteristics). . . . (59) New battery powered **tools** called Impactool for maintenance work in remote locations have been developed by Ingersoll-Rand Co., New York, N. Y.

(60) Electro-Seal Corp., Des Plaines, Ill., has increased their Electro-Pac "A" line of standby ac **power supplies** to six models, offering power outputs from 0.5 kva to 7.5 kva, 60 cycle ac, continuous duty. . . . (61) New auto **generator** which provides mobile power source, making it possible to use both power tools and home appliances, is now available from the 110 Generator Co., Los Angeles, Calif.

(62) Industrial Battery Div., Gould-National Batteries, Inc., St.

Paul, Minn., will now market a complete line of industrial **battery chargers** and static inverters. . . .

(63) Size 3½ magnetic **starter** rated at 40 hp, 220 volts and 60-75 hp, 440-550 volts has been introduced by Furnas Electric Co., Batavia, Ill.

(64) Leviton Mfg. Co., Inc., Brooklyn, N. Y., has introduced new "deep well" electric **clock hangers** available with either 2-wire parallel outlets or 3-wire U-grounded outlets. . . . (65) Six sizes of interchangeable **hubs** are now supplied for raintight service entrance equipment and safety switches manufactured by the American Electric Switch Div., The Clark Controller Co., Cleveland, Ohio.

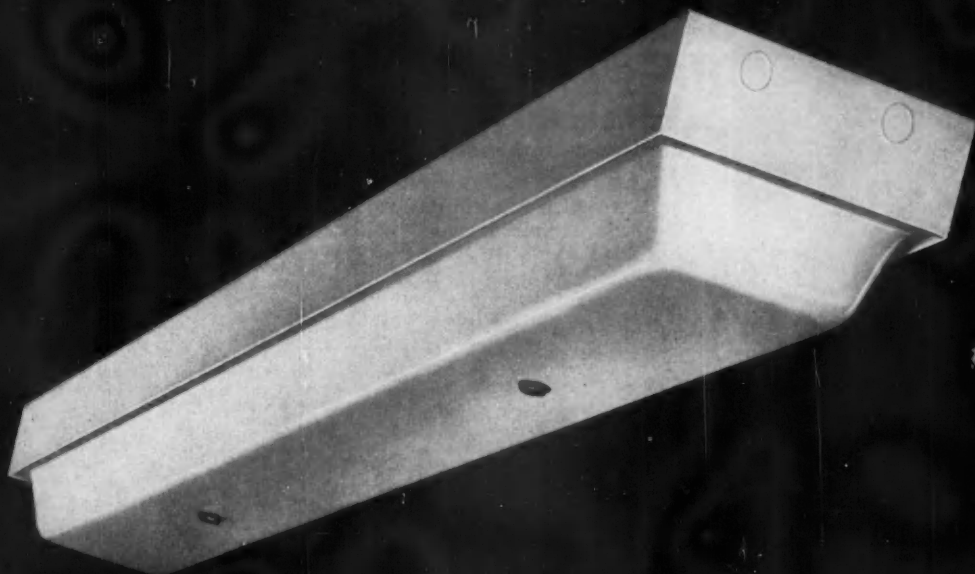
(66) Sola Electric Co., Elk Grove Village, Ill., has developed a new line of low cost constant wattage mercury **ballasts**. . . . (67) A cordless, portable, ½-in. power **drill** that operates in any position—upside down or sideways—has been developed by Savidge Specialties, Venice, Calif.

(68) ColorTran Industries, Burbank, Calif., announces the development of a long-life 500-watt quartz-iodine **lamp** for industrial and municipal lighting. . . . (69) New fluorescent **exit sign** series offered in 116 standard models plus several optional features including 277-volt operation, wire guards, and tamper-proof access doors, are now available from the Art Metal Lighting Div., Wakefield Corp., Cleveland, Ohio.

(70) Pyrotronics, Div. of Baker Industries, Inc., Newark, N. J., has announced the "Pyr-A-Larm", a nuclear **fire alarm system** that detects incipient fire without requiring the presence of visible smoke, flame or heat. . . . (71) New "Smooth Line" series of Bakelite **wall plates** have been announced by Eagle Electric Mfg. Co., Inc., Long Island City, N. Y.

(72) Marlow Pumps, Div. of Bell & Gossett Co., Midland Park, N. J., has announced the manufacture of a new 1,500-watt, portable, engine-driven **generator**. . . . (73) A new automatic home **fire detector system** designated "5130" is now available from Alarmatron, Inc., New York, N. Y.

(74) Lutron Electronics Co., Inc., Emmaus, Pa., has announced the addition of the Model D-900 to their line of continuous electronic **dimming controls**.



## the fixture to forget!

Once installed you can forget about Wheeler's Clean Lite except for an occasional wiping of the exterior surface with a damp cloth. This maintains light output. Clean Lite is the ideal fixture wherever food is processed or prepared.

Architects and consulting engineers have been specifying the Clean Lite in many building programs for food service areas. In particular, food processing areas, bakeries, school and college cafeterias have installed Clean Lite fixtures to meet exacting sanitation and maintenance demands. The performance and maintenance reports are very gratifying.

No danger of lamps accidentally dislodging into food

batches — no worry about cleanliness. Its smooth exterior will not harbor vermin attracting accumulations. The clear or white acrylic cover will withstand most atmospheres especially those where dust, moisture, fumes or strong drafts are common. Clean Lite is the fixture to use when these factors may affect proper operation of lamps, cause deterioration of the reflecting surface, create high maintenance costs or actually shorten fixture life.

In the Clean Lite, cleanliness is second only to light output. For more details and specifications, write to Edmund Quintiliani, National Sales Mgr., Wheeler Reflector Co., Hanson, Mass.

**WHEELER REFLECTOR CO., INC.**

HANSON, MASSACHUSETTS



The Clean Lite is available in 4' or 8' lengths in painted, porcelain enamel finish or aluminum and is ideal for the following locations: • **FOOD PROCESSING • PARKING GARAGES • BAKERIES • LAUNDRIES • BREWERIES • CHEMICAL PLANTS • CANNERIES • KITCHENS • SERVICE STATIONS • WASH ROOMS • WAREHOUSES • PRINTING PLANTS • LOADING PLATFORMS • LOCKER ROOMS • DAIRIES • DRY WORKS • PACKING PLANTS • ENTRANCES AND EXITS • PLATING PLANTS • BOILER ROOMS • COOLING ROOMS • TRAIN PLATFORMS • PASSAGEWAYS • STEAM ROOMS.**





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SOLID ONE-PIECE STEEL

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1/2" TO 2"

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## Catalogs & Bulletins

(75) **COMMUNICATIONS SYSTEMS.** Multi-resident communications systems are described in new bulletin including applications of the system to dormitories, residence halls, large apartment houses, etc. Communications Systems Div., Dukane Corp.

(76) **FLUORESCENT** and incandescent lighting fixtures are illustrated in 12-page catalog. Edwin F. Guth Co.

(77) **PRECISION POWER RESISTORS** are described in 16-page catalog. California Resistor Corp.

(78) **HEATERS.** Revised 52-page Catalog GEC-1005L lists product and application data for "Calrod" tubular, finned tubular, cartridge, strip, insertion, aluminum vane heaters; immersion heaters for viscous fluids; radiant heaters; and circulation heaters. General Electric Co.

(79) **MOTOR MOUNTS.** Bulletin 1107 describes new line of motor mounts for assembling chain- or belt-connected motors with speed reducers. Falk Corp.

(80) **LIQUID CONTROL.** 32-page catalog describes expanded line of floatless liquid level control components and systems for use in food, beverage, dairy, drug and chemical processing applications as well as municipal, industrial and commercial water supply and waste disposal systems. The B/W Controller Corp.

(81) **LOAD CENTERS.** New Uni-Pak residential load centers which use the recently-introduced EQ-225 breaker as main disconnect are featured in 4-page Bulletin 9101-1A. I-T-E Circuit Breaker Co., Walker Div.

(82) **RELAYS.** 36-page catalog and engineering handbook describes telephone type relays in a wide range of sizes and contact combinations; general purpose relays; rotary crystal can relays, and Magnereed dry reed relays. Magnecraft Electric Co.

(83) **IMPACT WRENCHES.** 12-page catalog includes specifications on six new air powered models, an electric model and an electric impact wrench kit. Skil Corp.

(84) **WALL PLATES.** 40-page catalog describes wall plates for homes,

stores, offices, industrial and all commercial installations and replacement purposes. Bell Electric Co.

(85) **DISTRIBUTION CENTER.** Bulletin 61C1258 describes AC/DC—a new concept for utility distribution substations. Allis-Chalmers Mfg. Co.

(86) **CEILING SYSTEM.** The new Colamar Mark-50 integrated ceiling system is described in 4-page Booklet B-8255. Westinghouse Electric Corp., Lighting Div.

(87) **MOTOR CONTROLS.** Size 2 low-voltage motor controls, available in 2- and 3-pole design, are described in Bulletin 14B1284. Allis-Chalmers Mfg. Co.

(88) **HOME HEATING** package includes four brochures on baseboard heaters, a heat loss calculation guide, a heating cable, wall and ceiling heater bulletin and price sheets. Anchor Mfg. Co.

(89) **SWITCHES.** Bulletin LU-30 describes line of Type LP plug-in oiltight limit switches. Cutler-Hammer Inc.

(90) **ELECTRIC HEATERS.** Bulletin A00100 illustrates full line of Chromalox electric process and comfort heating equipment with explosion-resistant construction. Edwin L. Wiegand Co.

(91) **ELECTRICAL INSULATION SYSTEMS.** 24-page Bulletin 66-6 describes effects of corona on performance of electrical equipment, corona detection and measurements and selection of corona test equipment. James G. Biddle Co.

(92) **LIGHTING.** 4-page folder describes new "Delta-7" exterior wall brackets with illustrations and application data. McPhilben Lighting Inc.

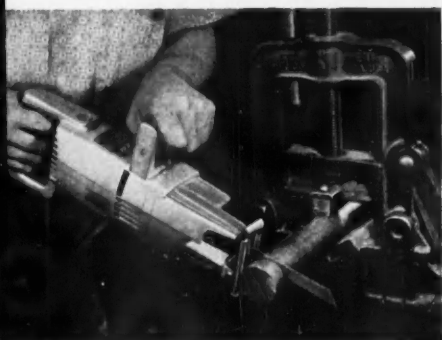
(93) **TV SYSTEMS.** Compact master TV reference manual describes typical installations that can be placed effectively in TV showrooms and service shops, apartment houses, as well as hotels, motels and other institutions. Blonder-Tongue Labs.

(94) **TERMINAL BLOCKS.** Data Sheet 62-10 provides technical information on Series 1215 terminal blocks designed for high temperature operations (850°F). Kulka Electric Corp.

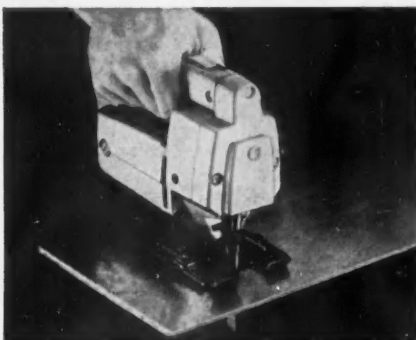
(95) **EXIT SIGNS.** New complete Pathfinder line of directional signs are described in 4-page folder. Miller Co.



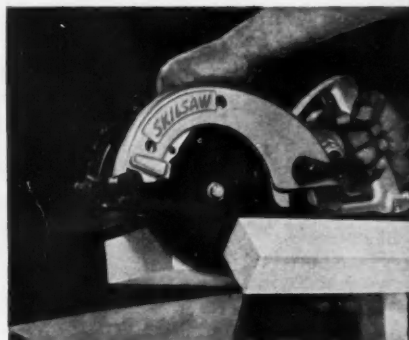
# 9 Do you know about these NEW SKIL Power Tool Ideas?



**NEW IDEA—Electric Hacksaw!**  
Has 2 speeds for cutting all metals from stainless and cast iron to mild steel, non-ferrous metals! (Model 701).



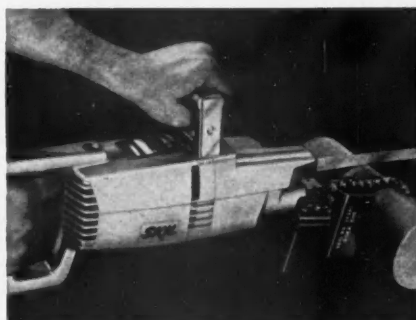
**NEW IDEA—2-Speed Jig Saw!**  
World's fastest—high speed for cutting wood, plastic, composition; low speed for metals (Model 160).



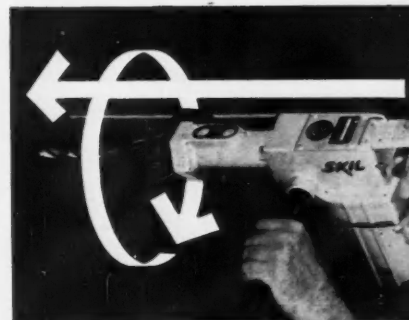
**NEW IDEA—Skil Saw Worm Drive Saw Under \$100.** Has unequalled cutting power; safety clutch. Cuts wood, metal, stone. (Model 65).



**NEW IDEA—Treaded Disc Sander Pad.** Prevents disc slippage. Quick change nut locks on steel pins—no clogged threads! (all Skil Disc Sanders)



**NEW IDEA—Recipro Saw With Built-In Vise.** Makes cutting of pipe and bar stock easy, fast and accurate (Model 702).



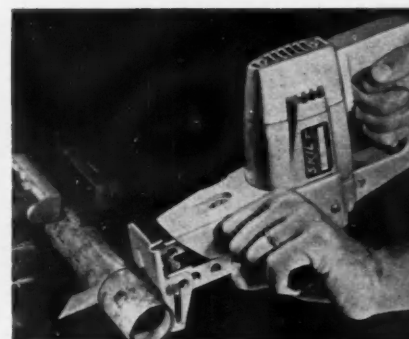
**NEW IDEA—3-Way Hammer.** Hammers, drills, does both simultaneously for fastest masonry drilling at lowest cost per hole (Model 726).



**NEW IDEA—Air Impact Wrenches with "Balanced Blow."** Deliver more power than costlier makes without jarring "kickback." Many models.



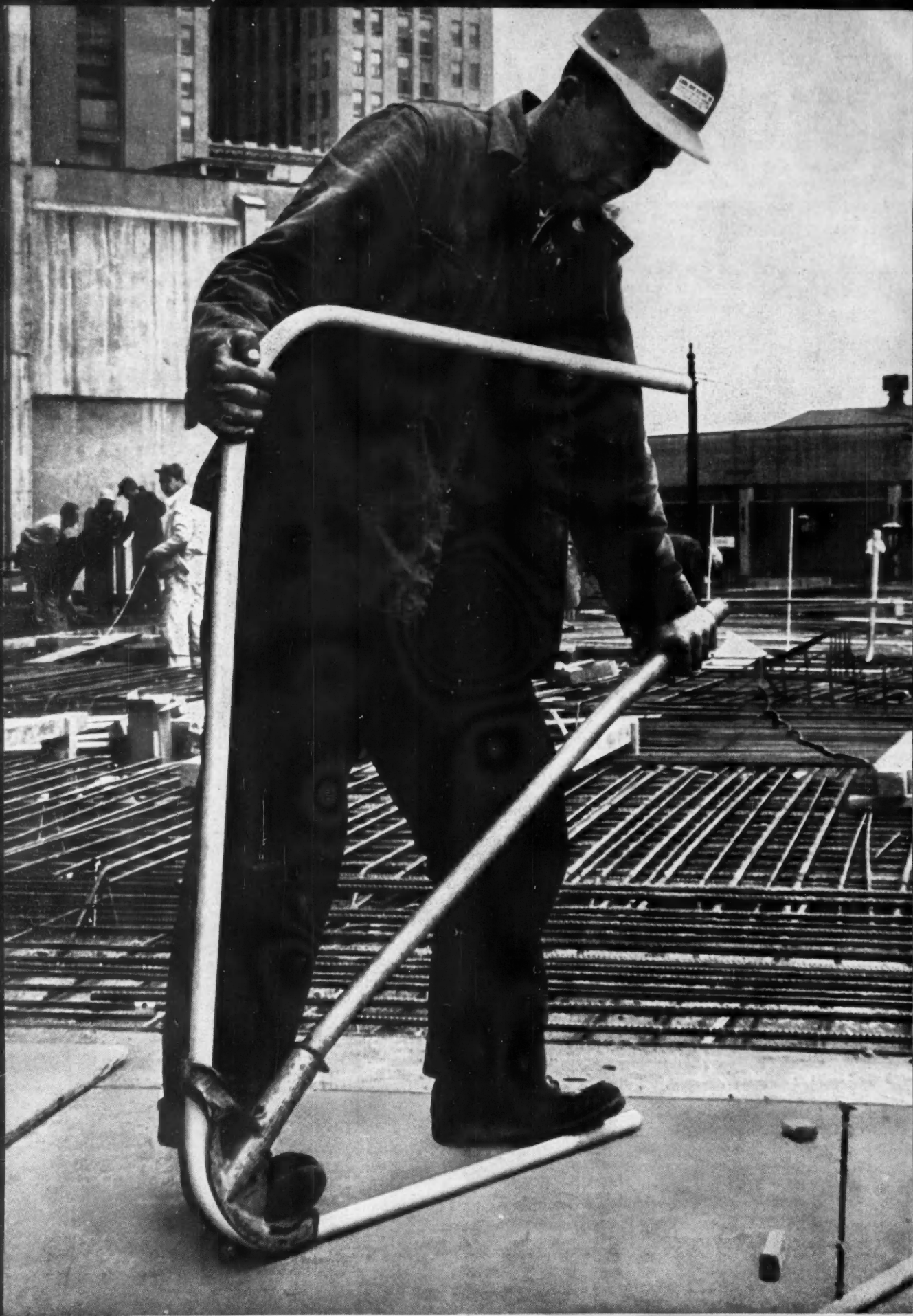
**NEW IDEA—2-Way Sander.** Orbital action for fast sanding . . . straight line action for finest finishing! Big 4½" x 9" pad. (Model 692).



**NEW IDEA—Only All Purpose Saw Under \$50.** Cuts metal, wood up to 6 inches thick. Cuts into corners, walls. Makes scroll cuts too (Model 577).

Ask your Skil distributor for demonstrations. Look under "Tools-Electric" in the Yellow Pages. Or write for 68-page catalog: Skil Corporation, 5033 Elston Avenue, Chicago 30, Illinois, Dept. 130-J

**SKIL**  
POWER TOOLS





## SAVINGS YOU CAN SEE

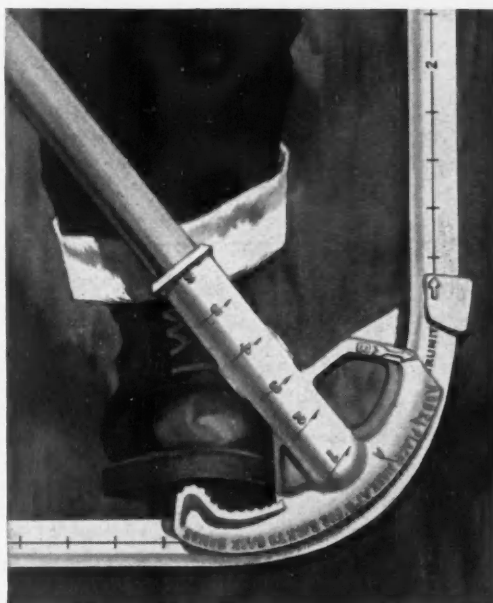
***Full length "GUIDE-LINE"  
on Republic ELECTRUNITE®  
eliminates costly "wows"***

Look closely. ELECTRUNITE Electrical Metallic Tubing has special markings that help you get the job done faster, at lower cost.

Running the full length of the tube is a "GUIDE-LINE"® that helps you make even the most difficult bends the first time. Used with Republic Benders, this line helps eliminate time spent forcing "wows" into line . . . time spent straightening and rebending conduit.

You'll also see that ELECTRUNITE is marked in feet and inches with "INCH-MARKS"®. These marks save you up to 30 seconds per measurement. You avoid the problem of a flat rule on a round tube . . . make accurate stubs and even back to back bends without trial and error fittings.

ELECTRUNITE's exclusive features reduce costs, put extra profit in your electrical installations. Prove it on your next job. For complete information, contact your Republic representative today or mail the coupon.



**QUICK AND EASY!** Exclusive "GUIDE-LINE" runs the full length of the tube. Used in conjunction with the famous Republic bender, this line helps you keep difficult bends in the correct plane.

Compatibility and strength  
characterize raceways made of  
Galvanized Steel



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**REPUBLIC STEEL CORPORATION**  
STEEL AND TUBES DIVISION • DEPT. A-3749  
212 EAST 131st STREET • CLEVELAND 8, OHIO

Please send complete information on the installation advantages of  
ELECTRUNITE E.M.T.

Name \_\_\_\_\_ Title \_\_\_\_\_

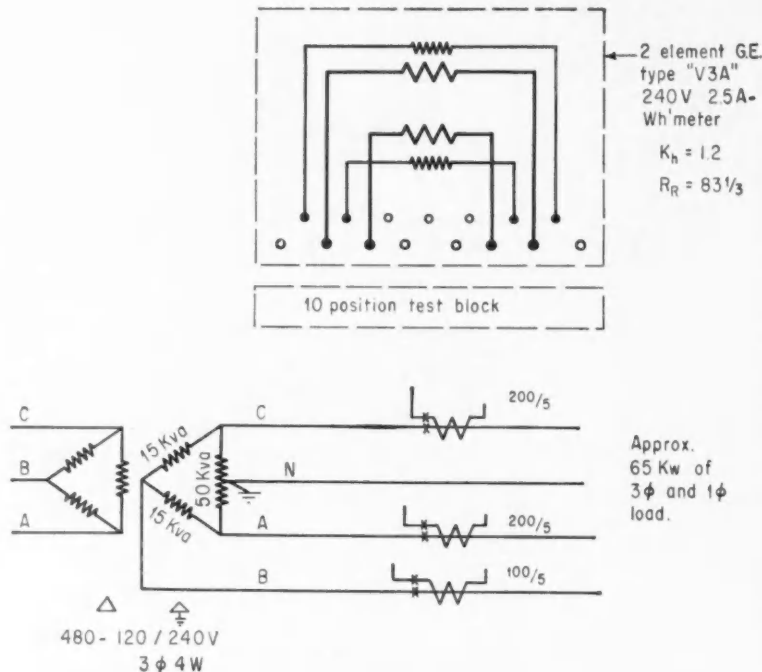
Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay \$5.00.



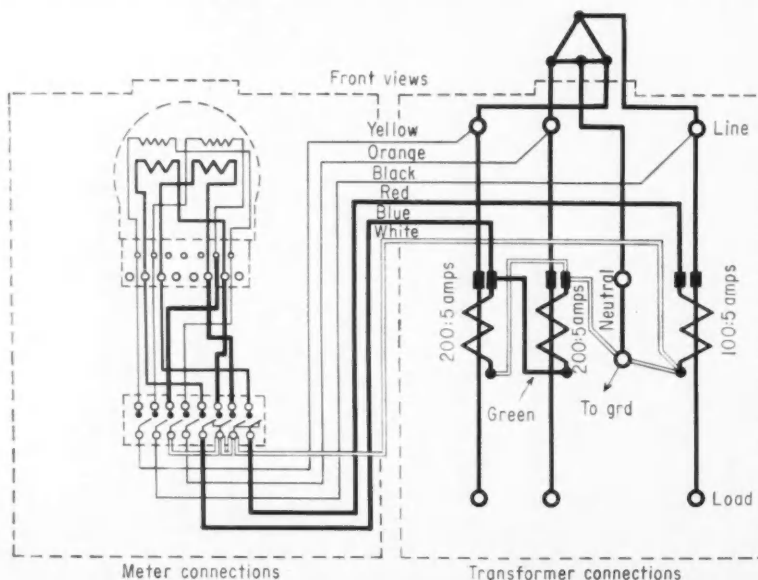
## Meter Connections

**QUESTION P41**—Can you help me out on a WH-meter installation? What is the correct connection diagram? How accurate will the WH-meter show the true load?

This system was working before but by moving the bank, I

got confused as to how to connect the current transformers and the meter. See sketch above.—A.C.

**ANSWER TO P41**—The wiring diagram below shows complete connections for the 2-element meter, current transformers and test switches. This diagram is an exact



duplicate of one used by a major meter manufacturer for a packaged transformer-meter mount containing the same components listed by you. The only difference is that the size of the current transformers in the original sketch were larger; however, for the load you show, your CTs are sized properly. Be sure to follow the wiring diagram carefully, observing the polarity markings and current and potential connections to the letter. This should provide an accurate reading for you, depending on the accuracy of the current transformers. If you care to test the accuracy of this set up, I suggest that you obtain a copy of the book, "Electrical Metermen's Handbook," published by Edison Electric Institute and available through them at 420 Lexington Ave, New York City. This handbook contains complete data on testing meters, current transformers and related components and is very helpful to those interested in understanding and solving metering problems. In addition, you should write to General Electric Co. for data concerning the V3A meter, and do the same with the manufacturer of the current transformers used in your installation. As an added thought, the V3A meter can be used on a 120-240-volt, 4-wire delta supply with only two current transformers provided that one of the CTs is a 3-wire type. The connections for this arrangement are shown in General Electric's pamphlet No. GEA-5878B. The accompanying diagram is shown in Bulletin 570, published by the Sangamo Electric Co., Springfield, Ill.—R. J. K.

## Time-Clock Loads

**QUESTION Q41**—How many 400-watt mercury-vapor bulbs can be controlled by a 40-amp double-pole time clock?—H.S.

**ANSWER TO Q41**—The solution of your problem depends on the magnitude of the currents required for the ballasts. The circuit voltage and the type ballast, which you failed to specify, directly affect the amplitude of the current.

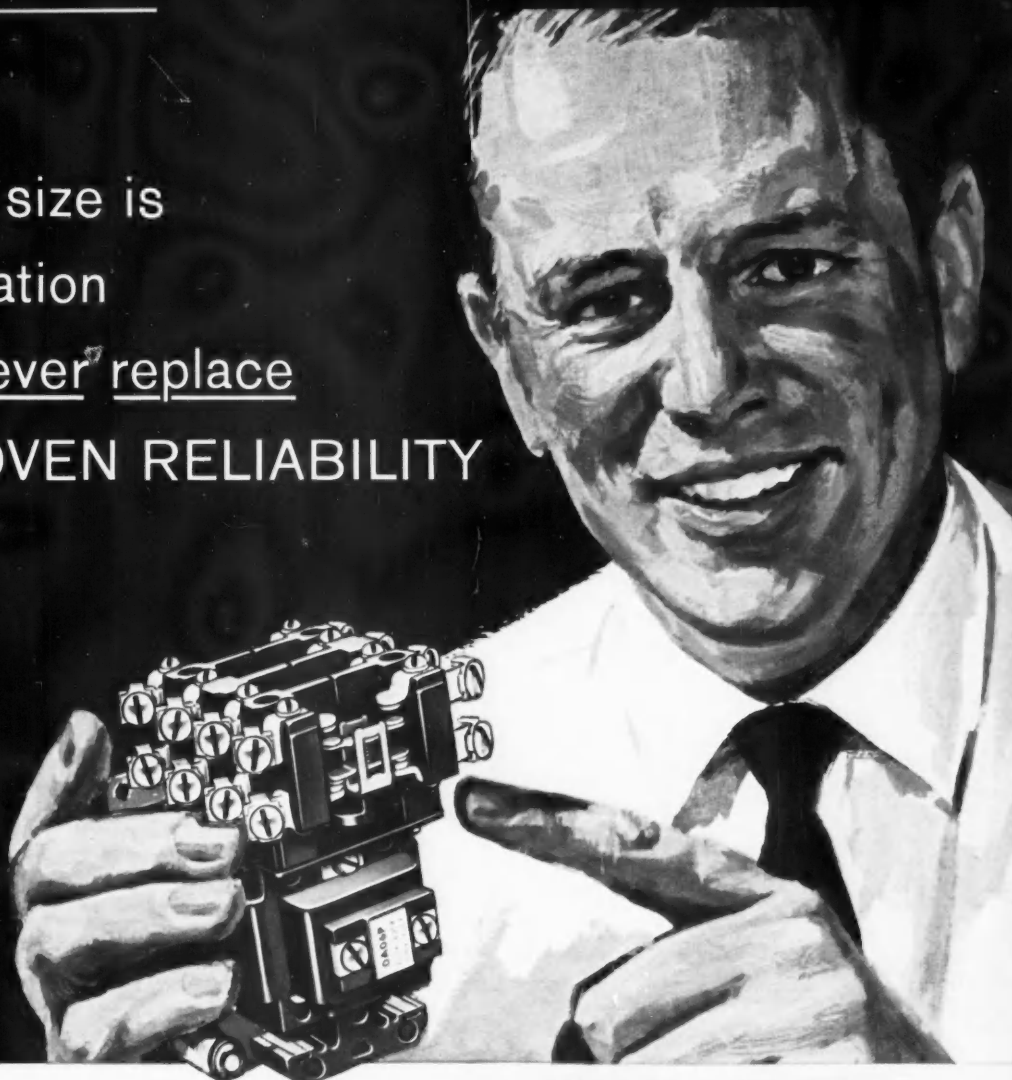
Let us logically assume a 240-volt



Sure, relay size is  
a consideration  
—but it'll never replace  
TIME-PROVEN RELIABILITY



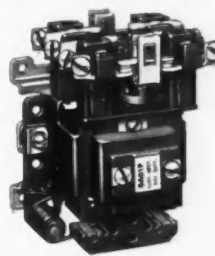
Bulletin 700  
Type BX Universal  
Relay with Both N.O.  
and N.C. Contacts



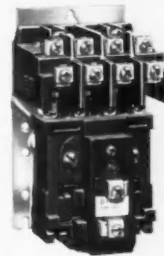
With the growing complexity of control systems, there's always pressure on you to make your motor control panels more and more compact. But, you must never forget the most important factor of all —reliability—and Allen-Bradley's *time-proven reliability* provides many more millions of trouble free operations than you can get anywhere else.

Over many, many years Allen-Bradley Bulletin 700 control relays have consistently demonstrated their ability to outperform and outlast any other relays on the market. This position of leadership has been maintained through constant refinements. Only recently, improvements in the contact structure have increased the mechanical life and electrical reliability *at least ten times!* Then, there's the newly developed pressure molded coil. It's fully protected against the worst possible atmospheric conditions, as well as mechanical abuse. These are just a *few* of the reasons why the mechanical life of many A-B relays *exceeds 50 million operations.*

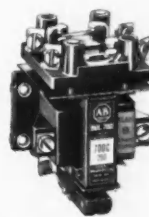
The Bulletin 700 relay line is complete, too. There's a type built to satisfy your particular requirements—just a few of the more popular units are shown here. So, be sure to get complete information on all of A-B's quality relays by writing for Descriptive Bulletin 700: Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin. In Canada: Allen-Bradley Canada Ltd., Galt, Ontario.



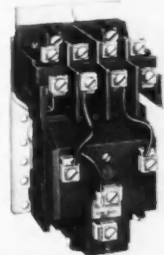
Type B General  
Purpose Relay



Type BR Relay with  
Convertible Contacts



Type C Small Size  
General Purpose Relay



Type BRM Relay with  
Permanent Magnet Latching

26-08-2C

# ALLEN-BRADLEY

Member of NEMA

**QUALITY  
MOTOR CONTROL**

# Analyze These Timing Relays ...There's One for Every Job— Each One is A-B QUALITY!

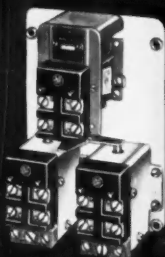
Feast your eyes on this line of Bulletin 849 pneumatic timers—you'll quickly see there's a style for almost every timing requirement. And to this, A-B timers add remarkable reliability and long life—operations that are "on time" . . . *millions of times*. You'll have versatility, too. The delay period is easily varied from 1/20 sec. to 3 min. with an accuracy of  $\pm 10\%$ . And, conversion from ON-DELAY to OFF-DELAY (or vice versa) takes moments—no adjustment is needed. Please write for Technical Bulletin 849: Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.



**STYLE C** "On-Delay" Timer for DC



**STYLE ABX** Double Unit "On & Off Delay" Timer for AC with One Set of Auxiliary Contacts



**STYLE HX** "On-Delay" Timer with Two Timing Units for AC and One Set of Auxiliary Contacts



**STYLE A** Standard "On-Delay" Timer for AC

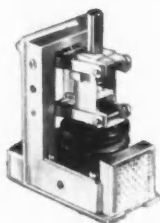


**STYLE AXX** Standard "On-Delay" Timer for AC with Two Sets of Auxiliary Contacts

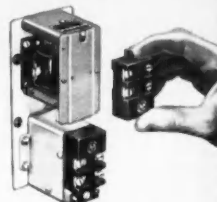
**GREATER FLEXIBILITY** in switching is possible with the single pole, double throw timing contact block which provides two electrically independent control circuits. This can frequently eliminate the need for a control relay.



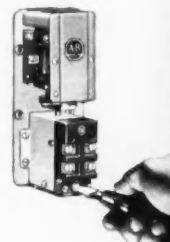
**SIMPLE DESIGN** and precision manufacturing gives A-B pneumatic timing units the consistent accuracy for which they are famous. Temperature variations from 32°F to 104°F have little effect on the setting.



**AUXILIARY CONTACTS**, similar to the contact block for the timing unit, can be added to the standard timer. The unit is mounted directly on the solenoid frame in a simple field operation.

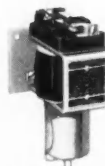


**FRONT ADJUSTMENT** makes it easy to set the timing period. And an anti-backlash spring assures precise adjustments. Made with or without a numbered dial to provide a reference position.



## OTHER ALLEN-BRADLEY TIMERS

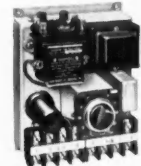
The complete line of Allen-Bradley timing relays includes the exact type to provide the accuracy, reliability, operating speed, recycling rate, and contact arrangement to satisfy your design requirements. And each is built to provide years of trouble free, maintenance free performance.



Bulletin 848 Fluid Dashpot Timing Relay



Bulletin 850 Motor Driven Process Timer



Bulletin 852 Electronic Timing Relay

# ALLEN-BRADLEY

Member of NEMA

**QUALITY  
MOTOR CONTROL**

single-phase circuit for use with your double-pole 40-amp time-switch, being protected by an equally rated circuit breaker, and utilizing high-power-factor reactor-type ballasts.

A typical 236-volt ballast for a 400-watt mercury-vapor lamp is rated at 426 watts, 90% power factor, operating current of 2.0 amps. Since the starting current surges at 175% to 150% through several minutes duration we should use 3.5 amps for the amplitude of the starting current. Your 40-amp equipment can thus start *about* eleven ballasted lights without exceeding its rating.

"About" has been deliberately used since the ballast current can increase if circuit voltages are above or below the rating, and surge characteristics can vary with different ballasts. If the possible pitting and burning of the time-switch contacts by overcurrent starting is not objectionable, and if the circuit protective device has adequate time delay, you could start more than the eleven ballasted lights if they are based on the 2.0 amps operating current.

If you use low-power-factor ballasts with 3.2 amps operating current, or 5.6 amps starting current, then only seven ballasted lights could be started within the time-switch rating.

If the circuit voltage available is only 120 volts and you use two branch circuits, the high-power-factor ballast's operating current would be 4.5 amps and the low-power-factor ballast's would be 6.5 amps. Starting currents would be 7.9 amps and 11.4 amps respectively. This would permit about five ballasted lights per circuit for the high pf ballast and three per circuit for the low power-factor ballast.

It is also possible to control as many lights and circuits as required by using a contactor, in which case the time clock would control the holding coil of the contactor.—I.P.

**ANSWER TO Q41** — 400-watt mercury-vapor lamps are typically rated at 3.2 amps operating current at a potential of 220 volts open circuit.

Good engineering practice dictates that devices controlling continuous loads such as lamps should be rated at 125% of the normal full load controlled. Therefore, the load should be limited to 32 amps which in your case is exactly 10 lamps.—J.A.M.



## ZOOM FROM NARROW TO WIDE BEAMS AT WILL WITH THIS REMARKABLE STONCO FLOODLIGHT FOR QUARTZ IODINE LAMPS

What can you do when the floodlights are up and beams too-wide spill over?

Or beams too-flat wash out the brightest buildings.

Or beams too-tight checker areas with darkness. These things happen, even when lighting layouts are made with loving care.

Stonco has the answer. A new kind of floodlight with a built-in focusing device. With it you can actually dial the beam you need. It's easy to do, yet very scientific. Like a zoom camera.

The results leave little to be desired. Layouts are virtually goof-proof. They should be. When coverage is not on-target, you just change the beam

until you are satisfied. Right on the job. With a twist of the wrist.

There are no complications. No special reflectors. No special lenses. For most jobs, one floodlight does it all. Beautifully. Efficiently. Economically.

Want all the facts? Drop us a card.

### Stonco plus features:

- Built-on bubble level.
- Built-on rifle sight.
- Horizontal leveling device.
- Safe rear re-lamping.
- Wrap-around lens-shield.
- Built-in splice chamber.
- Vertical aiming quadrant.
- Arm-gripping locking teeth.



**NEW. Very Narrow Spot.** 5° vertical beam spread. Astonishing white-to-black cut-off. Especially effective for race tracks, narrow signs — any location where a dazzling ribbon of light is required.

# STONCO





## LOOK! a 200-amp breaker no bigger than this

Heinemann's SE-33 circuit breaker (shown actual size) needs only half the panelboard space of comparably-rated breakers. In an enclosure (indoor and outdoor types available), it's considerably smaller than a fused switch or pullout of equal rating. A two-pole breaker, the SE-33 is magnetically actuated—never has to be de-rated for high ambient temperatures. It accepts

copper or aluminum conductors in sizes from #6 to #250, CM, CU/AL, has pressure-type solderless connectors. Available in standard ratings of 125, 150, 175 and 200 amps, 120/240V AC. Priced advantageously. Bulletin 1003 will give you detailed information.



**HEINEMANN ELECTRIC COMPANY** ♦ 2606 BRUNSWICK PIKE, TRENTON 2, N. J.

## Lightning Arresters

**QUESTION R41**—A sawmill consisting of several scattered buildings has a 440-volt 3-wire, 3-phase ungrounded overhead distribution system originating from a 750-kva platform-mounted transformer station, centrally located between the various buildings. There are no fuses or breakers in either the primary or secondary side of the overhead wiring on the sawmill premises. The electric utility has fused drop-outs in the primary two spans away from the transformers at the property line where it is tapped to a shielded feeder. Each building has standard 440-volt fused disconnect service equipment at the termination of each service drop.

As a result of a number of claims of lightning damaged motors, the insurance company has suggested the installation of lightning arresters at the service head of each building, one arrester per phase wire connected to a driven ground rod. Ground resistances of such electrodes in this vicinity run in the order of 50 to 300 ohms. There is no common underground water piping system on the premises.

Will arresters installed under the above conditions be of any practical value, and if not, what would you recommend?—R.B.F.

**ANSWER TO R41**—I think that it is desirable to follow the advice of the insurance company, who has had considerable experience in these matters. However, carefully review Part M of Article 250, and Article 260. These code rules govern the installation and grounding of lightning arresters. Properly installed, the arresters should help the situation quite a bit. I think your problem has been due to high voltages which were electrostatically induced in outdoor electric lines during lightning storms. These voltages produce traveling surges of high voltages which travel along the lines to electrical equipment. As a result, the high induced voltages puncture the insulation of equipment, particularly motors because of rather skimpy insulation between windings and to ground. Lightning arresters limit these voltages to a safe value and provide a path to ground for the dissipation of the energy of the surge. In all areas where lightning disturbances are prevalent, overhead electric conductors should be protected by arresters. In view of the fact that you have not indi-



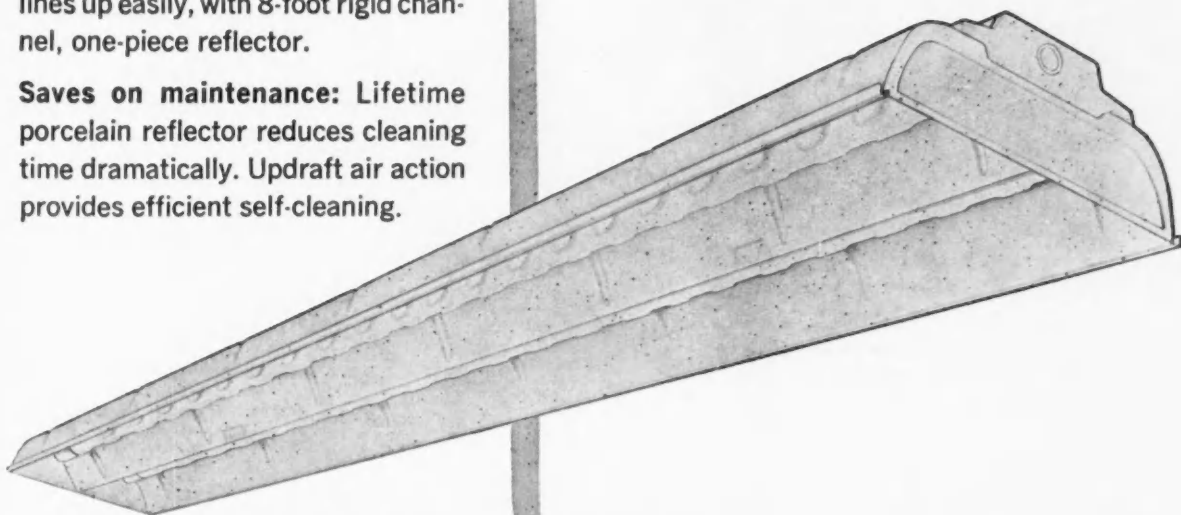
THIS FIXTURE NOW AVAILABLE AT

## LOWER COST

**Saves on initial cost:** Price reduced 10% with no change in fixture quality or performance.

**Saves on installation:** Goes up fast, lines up easily, with 8-foot rigid channel, one-piece reflector.

**Saves on maintenance:** Lifetime porcelain reflector reduces cleaning time dramatically. Updraft air action provides efficient self-cleaning.



## THIS FIXTURE IS THE SAME HIGH QUALITY

Delivers high footcandles for faster seeing, faster working. But that's not all! 25% uplighting reduces harsh visual contrasts between work surfaces and walls and ceilings. Result: improved seeing comfort, less fatigue. And because of updraft air, fixture and lamps catch less dirt, light output stays up far longer.

YOU GET

## BOTH IN DAY-BRITE CFI®-25

Now when you specify industrial lighting equipment, there's no reason to sacrifice performance for price...no need to settle for anything less than genuine Day-Brite quality. Get the whole story on Day-Brite CFI-25 for Rapid-Start, Slimline, High Output and Power-Groove lamps. Learn why it is today's biggest industrial lighting value—by far! Just call your Day-Brite lighting representative . . . or mail coupon today.

D-589



AN EMERSON ELECTRIC COMPANY

**DAY-BRITE LIGHTING, INC.**

*St. Louis, Mo., Tupelo, Miss., and Santa Clara, Calif.  
Amalgamated Electric Corp., Ltd., Toronto 6, Ont.*

**NATION'S LARGEST MANUFACTURER  
OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT**

Day-Brite Lighting, Inc.  
6260 N. Broadway, St. Louis 15, Mo.

ECM

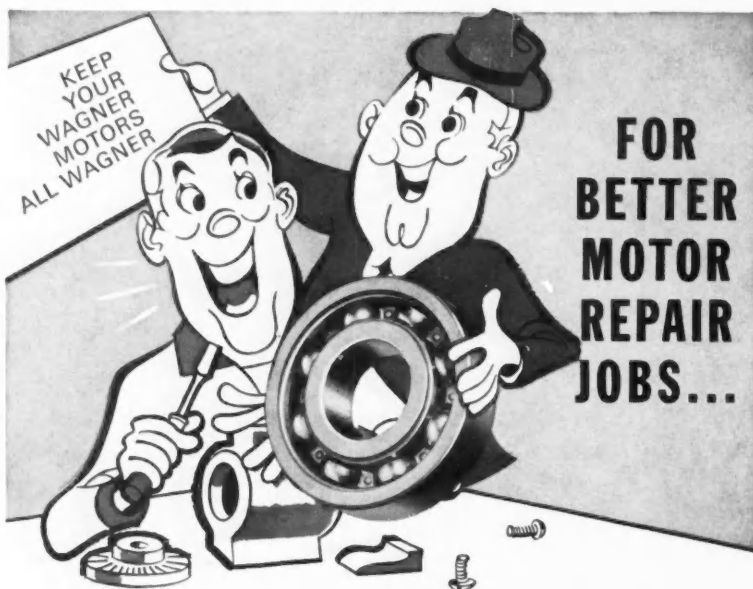
Gentlemen: Send new Cost and Comfort Comparison Chart on Day-Brite CFI lighting fixtures.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



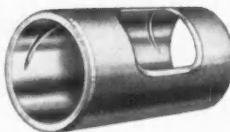
## USE WAGNER® REPLACEMENT BEARINGS

*they fit right and work right every time!*



**WAGNER BALL BEARINGS** are exactly right for the motor in which they are used. Always replace worn-out or damaged bearings with the same high-quality ball bearings used as original components. You're assured a better job in less time with complete customer satisfaction.

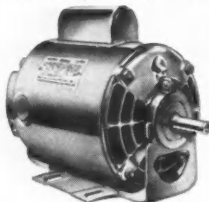
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cated any arrester protection on the part of the utility, you should discuss the over-all problem with them. Perhaps they can provide some added protection on their overhead lines.—R.J.M.

**ANSWER TO R41**—With ground resistances in the order of 50 to 300 ohms a grid system works good. If the buildings are not too far apart, loop a 1/0 or 2/0 underground wire between the buildings with a rod at each building and two or three (or more) rods in between. Connect the arrester grounds to this grid. If the buildings are too far apart to make this practical then fan out in two directions from the down conductors at each building for about 30 ft with a rod every 10 ft. I have had good results with both. Also I would like to suggest that you read the NFPA No. 78 manual on lighting protection.—W.E.G.

## Can You Answer These QUESTIONS?

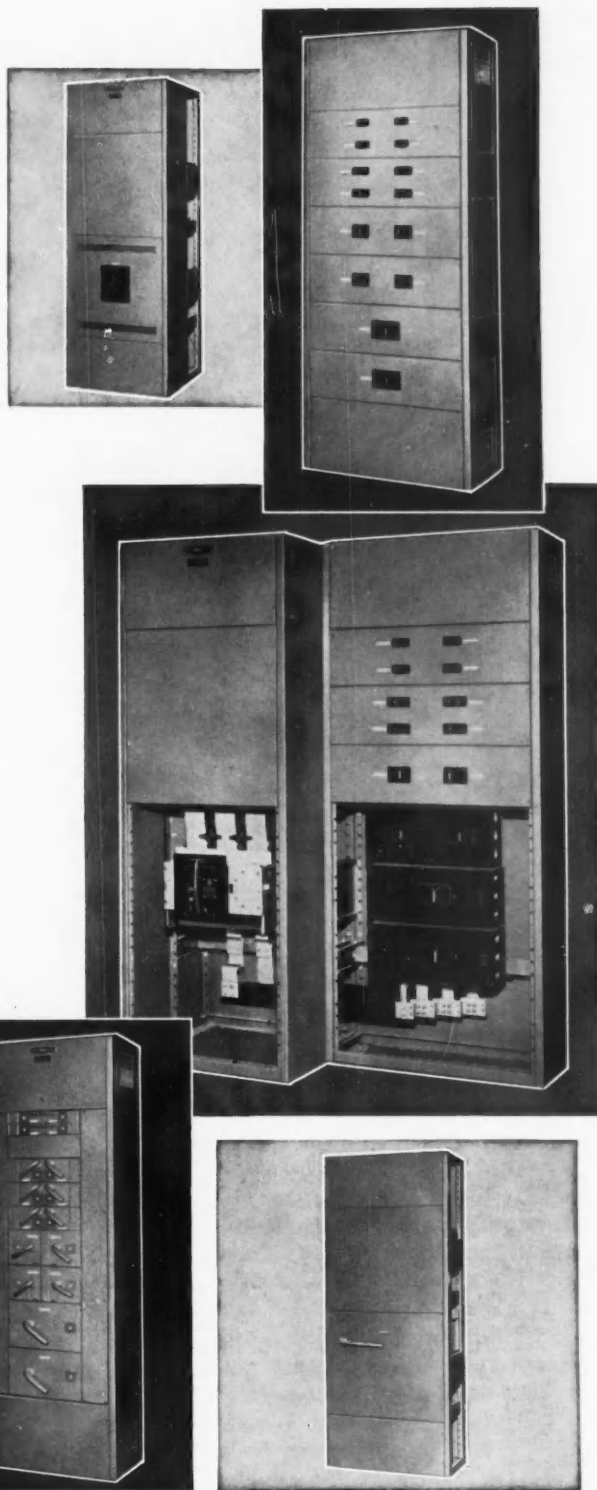
**QUESTION X41**—We have been informed that there is on the market a conductive asphaltic paint that is used to coat parking lots. In some manner, current-carrying electrodes are attached electrically to the painted surface. The paint, when energized, develops heat sufficient to melt snow in the winter time.

This sounds almost too good to be true. I would like information about this conductive asphaltic paint or any other similar method that can be used for snow melting in the winter.—J.A.M.

**QUESTION Y41**—We recently installed three very expensive motor control panels. Now we have been told that if there is a blow up or failure in one starter in this panel, it may cause other starters to blow up in this same panel. Could this happen or is it just idle talk?—W.F.R.

**QUESTION Z41**—Knowing the unbalanced single-phase kw outputs and power factor of a Scott-connected transformer bank, what is the easiest way to calculate the 3-phase input kw, power factor and line currents?—J.L.W.

**PLEASE SEND IN YOUR ANSWERS BY NOVEMBER 15**



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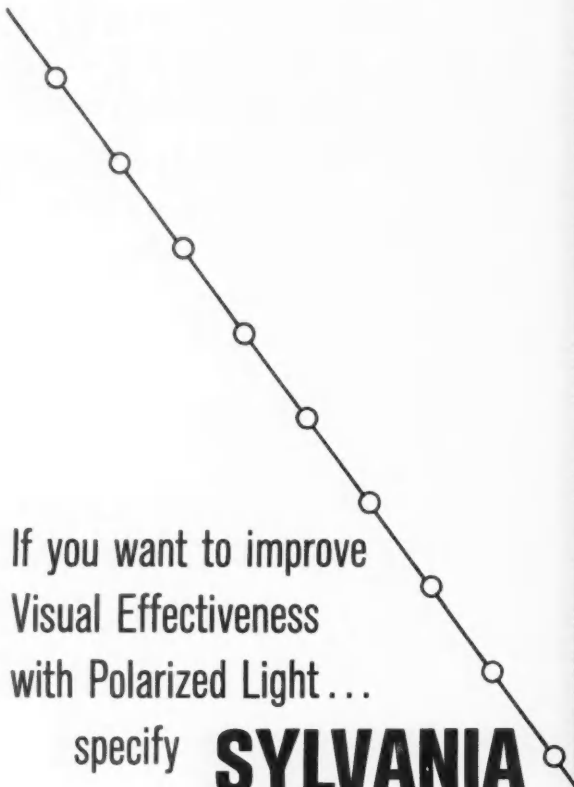
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\*\*Conducted by H. Richard Blackwell, Ph. D., Professor and Director, Institute for Research in Vision, The Ohio State University, Columbus, Ohio.



# Code Forum

Answered by:

**J. C. HEWITT**, Chief Electrical Inspector, Department of Labor and Industries, State of Washington, Olympia, Wash.

**B. Z. SEGALL**, Consulting Electrical Engineer, New Orleans, La.

**R. E. WARD**, Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.

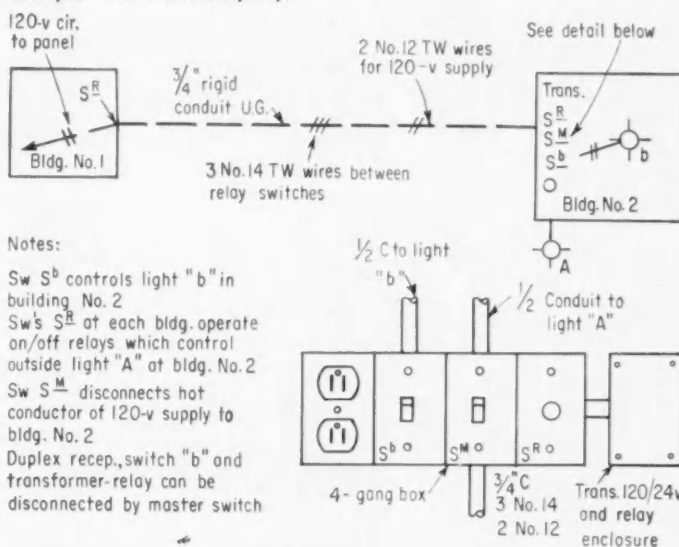
READERS are invited to submit questions regarding the National Electrical Code and its practical application to this Department. Questions are answered by the consulting editor whose initials appear at the end of each item. The views and opinions expressed are, in each instance, those of the individual consultant replying and are not necessarily those of his employers, of this publication or of a Code-making committee or panel on which he may serve in an official capacity.

## Supply and Control Circuits in Same Conduit

**Q.** Would it be a code violation to run 24-volt control wires in the same conduit with 120-volt conductors? The conduit extends underground from one building to another. See accompanying sketch. Notice that the 3-in. conduit contains three No. 14 TW wires for the ON-OFF low-voltage control switches located at each building, and these switches operate light "A" at building No. 2. The No. 12 TW conductors are for the 120-volt circuit to building No. 2. The master switch ( $S^M$ ) in building No. 2 disconnects the hot conductor to all 120-volt devices in this building. All TW wires are rated at 600 volts and all wiring is contained in conduits or metal boxes.—B.B.C.

**A.** Basically, the 24-volt-relay switching controls described by you would be classified as a Class 2 remote-control system. However, Class 2 systems may be considered as Class 1 systems, according to Section 725-16, if the conductors are insulated and installed as Class 1 conductors. Your statement and drawing seem to indicate the proper installation and insulation of the Class 1 conductors since all conductors have 600-volt insulation and are installed in conduit or metal boxes. The master switch ( $S^M$ ) disconnects the ungrounded conductor at building No. 2, which satisfies Section 230-76. Now the only thing that remains to be determined is whether or not the Class 1 remote-control conductors can be installed in the same conduit and boxes as the 120-volt supply conductors.

In your particular installation, this would be a border-line decision. The last sentence of Section 725-16 reads: "Power supply conductors may occupy the same enclosure or raceway with Class 1 system conductors when supplying only equipment to which Class 1 system conductors are connected." Notice the



emphasis on the last 12 words of this code rule. In your case, the No. 12 120-volt circuit supplies the primary of the 120/24-volt control transformer and the SP switch-leg contacts of the 24-volt relay. To this point there is no code violation. However, the power supply to building No. 2 also feeds a duplex receptacle and a second light, neither of which have any connection with the Class 1 system conductors. Since your installation would fully comply with Section 725-16 by the elimination of the duplex receptacle and light "b," I fail to see how a hazard would be introduced by their inclusion. Because of this feeling, I would hesitate to reject your installation since the underground conduit contains only the two 120-volt supply conductors in addition to the three control wires. At the 4-gang box in building No. 2, there seems to be a logical arrangement of devices to isolate the Class 1 control conductors from any 120-volt equipment having no connection with the control wiring. And, in my opinion, this is the intent of the code rule in question. At the same time I cannot advise you that the installation complies with the code because of the previously

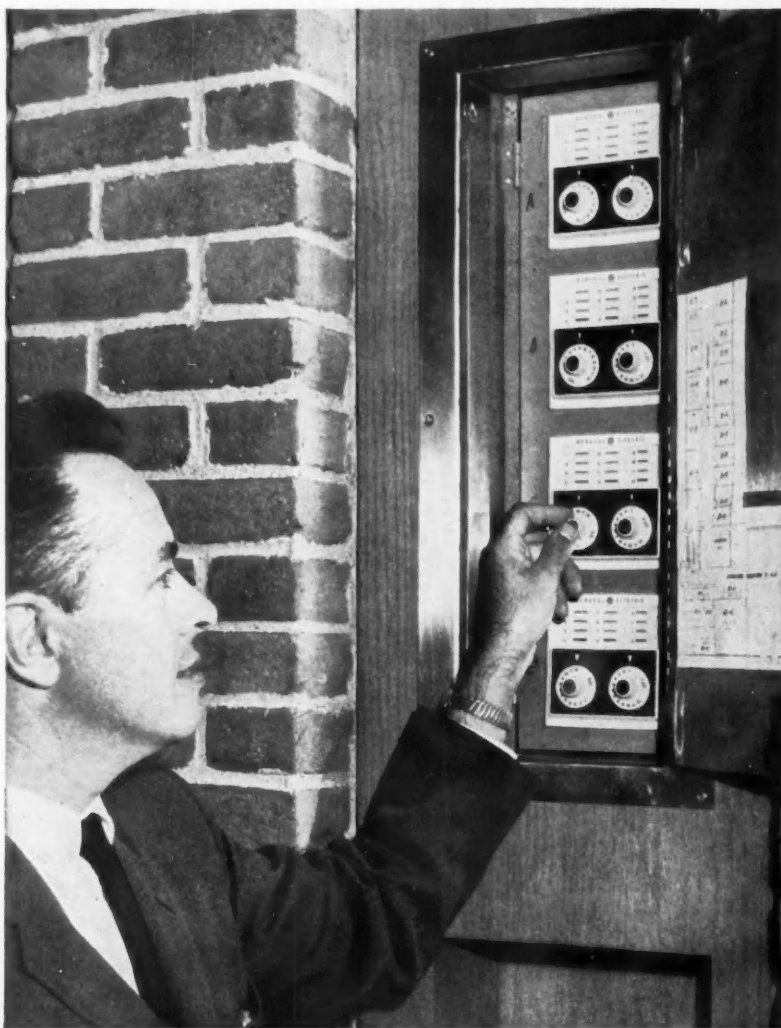
stated literal violation. An official opinion must be made by your local code authority. But I feel this is one instance where the inspector can base his decision on the intent of the code rather than the literal text, the latter of which cannot anticipate all situations that may arise.—J.C.H.

## Derating Conductors in Conduit

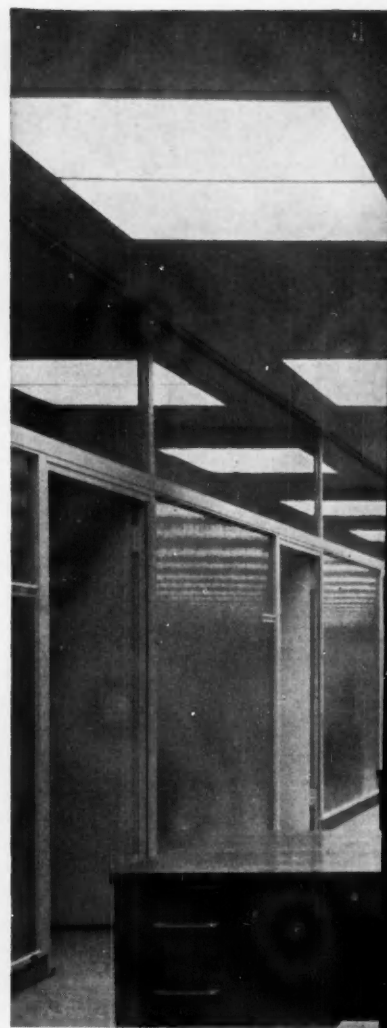
**Q.** One run of conduit will contain six conductors for two 3-phase motor circuits. Voltage drop has been considered in calculating the wire size, and 125% of the full-load current rating of each motor has also been used in computing the wire size.

Due to the fact there are more than three conductors in the raceway, should the conductors be derated as is required by Note 8 of Section 310-11?—B.B.B.

**A.** Your question is one that is not answered by the National Electrical Code, and is one that is supposed to be under study



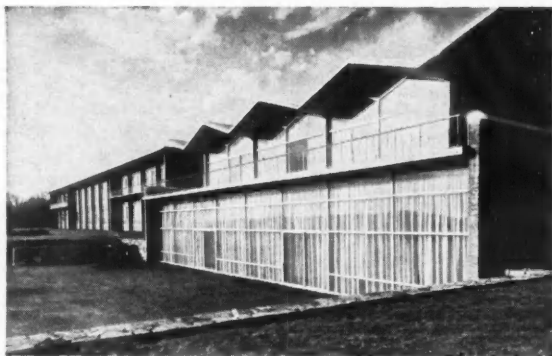
"You can easily 'dial' lights ON ahead of you or OFF behind you," says Mr. Johnson (above), "with



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Engineer, Raytheon Company Executive Offices, Lexington, Mass.

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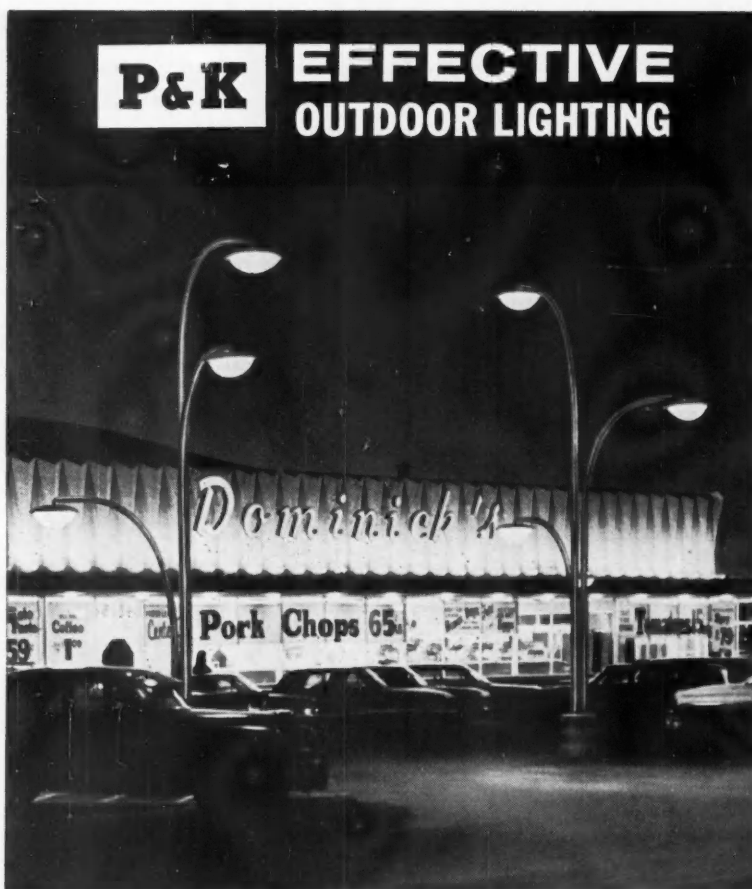


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by code-making authorities. Generally speaking, in cases such as you describe inspectors do not require further derating of conductors. The next edition of the code is supposed to contain examples along the line of derating.

In the proposed amendments there was a proposal asking for clarification of the wording of Sections 384-16(c) and 220-2. The panel comment regarding this proposal was that the intent of these two sections is quite clear and not in conflict. It is not the intent of the code to add a 25% increase in wire size on a 25% increase on load. The two sections mentioned above concerned protective devices not less than 125% of circuit loading in certain instances. The other section requires a 25% increase in unit loading in certain instances. Therefore, from the panel comment this could be used as a parallel case and the derating or increasing of wire size would not be required as is outlined in your question.—R.E.W.

### Panelboards Protected at Over 200 Amps

**Q.** Paragraph 384-16(b) states panelboards equipped with snap switches rated at 30 amps or less, shall have overcurrent protection not in excess of 200 amps.

Can a panelboard equipped with circuit breakers rated at 30 amps or less have overcurrent protection above 200 amps?—W.T.S.

**A.** Yes. If such panelboard is rated above 200 amps it would be classed under 384-16(a), which states: "A lighting and appliance branch circuit panelboard supplied by conductors having overcurrent protection greater than 200 amps shall be protected on the supply side by overcurrent devices having a rating not greater than that of the panelboard." In the Tenth Edition of the Abbott and Stetka National Electrical Code Handbook on page 301, the following note is recorded defining a snap switch:

"The term snap switch as used here and elsewhere in the code is intended to include, in general, the common types of flush and surface-mounted switches used for the control of lighting equipment and small appliances and the switches used to control branch circuits on lighting panelboards. These switches are now usually of the tumbler or toggle type but can be





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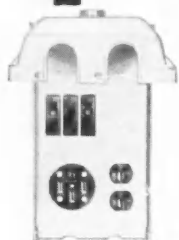


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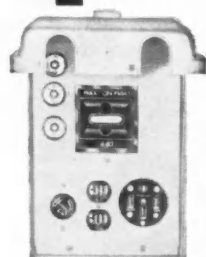


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the rotary-snap or pushbutton type. The term is not applied to circuit breakers or to switches of the type that are commonly known as knife switches."

You will note the last line states: "The term is not applied to circuit breakers or to switches of the type that are commonly known as knife switches." Therefore, if Paragraph 384-16-(b) applied to panelboards equipped with circuit breakers, the words *circuit breaker* would appear.

Official Interpretation No. 234 was issued November 30, 1942 based on the 1940 Code. This Interpretation is as follows: "Section 3882. Control Devices.

"Question 1: Was it the intent to include other control devices such as circuit breakers, knife switches, plug-in units, and so forth, in the limitation of the interim amendment which reads: 'Snap switches rated at 30 amps or less and employed in panelboards shall have overcurrent protection not in excess of 200 amps.'

"Finding: No."

"Question 2: What is the National Electrical Code definition of the term 'snap switch'?"

"Finding: There is none, but it was the intent in interim amendment No. 59 that the term should be applied to devices controlling branch circuits, the operation of which could not be manually halted when positive motion had once been imparted to the contact-making or closing member."—R.E.W.

## Wiring Continuous-Row Fluorescent Fixtures

**Q.** Can Type AF conductors be used as the branch-circuit supply for fluorescent fixtures connected end-to-end in a department store?—A.C.

**A.** According to Table 310-2 (a), Type AF conductors are listed for fixture wiring. And a footnote below the table states: "Fixture wires are not intended for installation as branch-circuit conductors nor for the connection of portable or stationary appliances." As a result, types approved for use as branch-circuit conductors would be required for the installation you describe.

By mentioning Type AF conductors, it is obvious that you were concerned with possible excessive temperature within the fixture that could damage the insulation of

standard Type T or R wires. While this problem has been recognized in the past, the 1959 NEC or previous editions did not provide a formal guide for the solution to the problem. However, a new sentence has been added to Section 410-26 for the 1962 NEC and should resolve past controversies on the subject at hand. The new sentence reads: "Branch-circuit conductors within 3 in. of a ballast shall be Type RHH or other types of conductors recognized for use at temperatures not lower than 90°C (194°F)."

In most instances, branch-circuit conductors, feeding through continuous-row fluorescent fixtures, would be within 3 in. of a ballast. When this occurs, Type RHH branch-circuit conductors, or equivalent types, would be required. Although Type RHH conductors are specifically mentioned, other equivalent conductors, which are recognized for use as branch-circuit conductors, and are rated at not less than 90°C include Types SA, AVA, and AVB. Therefore, you should use one of these types instead of Type AF conductors. The Type AF conductors would be a definite code violation.—J.C.H.

## Motion Picture Projectors

**Q.** Our company has the contract for wiring a lodge in a federal park. This building will house a historical display and have a small concession stand, restrooms and a store room. It will also contain a meeting room that will seat approximately 50 people. This room will be used as a lecture room with a historical movie to be shown to people visiting this park. There is no provision made in the building for a projection booth. Neither do plans or specifications call for special wiring for the projector except for an individual circuit. However, our contract requires that the wiring meet the 1959 National Electrical Code.

What method of wiring does the code require for such an installation?—W.B.R.

**A.** Article 540 covers motion picture projectors, and you will note from Article 540, Part B pertains to projectors of the professional type. Part C pertains to the non-professional type projectors. I am quite sure from your statement the non-professional type

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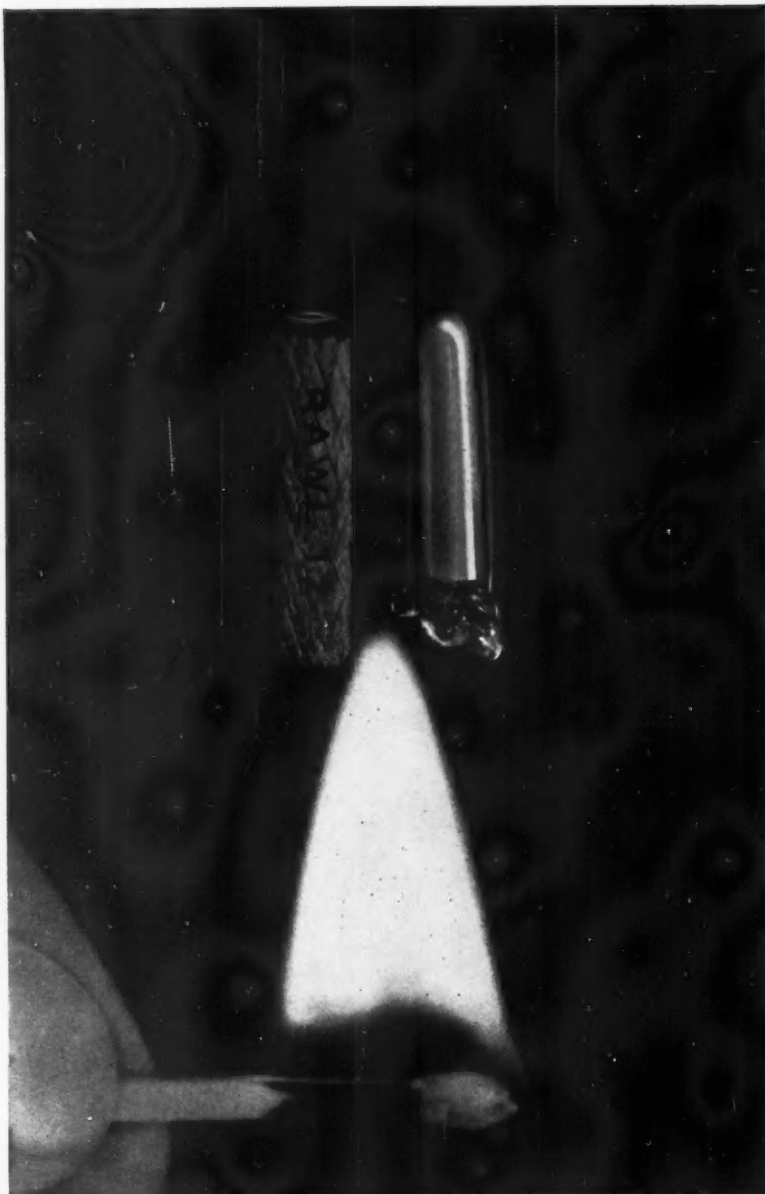
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projector will be used. This type of projector uses the slow-burning film, and a booth is not required for such an installation. The method of wiring may be any method approved by the code. Although a booth is required in the professional type, according to the definition of hazardous locations in Article 500, a motion picture booth is not classed as a hazardous location even though the film is highly inflammable. The film is not volatile at ordinary temperatures; therefore, no inflammable gases are present and the wiring installation is not required to be explosion-proof. However, such wiring should certainly be done with all care to guard against fire hazards. —R.E.W.

## 3-Phase Service For Dwellings

**Q.** *In a large single-family dwelling, the heating contractor installed a 3-phase, 240-volt 40-kw electric furnace. Is a 3-phase 240-volt service permissible in a single-family dwelling according to the NEC? If the answer is "yes," what service and conductor sizes would be required?—A.J.*

**A.** Paragraph 210-6 (b) states that, in dwellings, the voltage between conductors shall not exceed 150 volts for receptacles, lampholders of the screw-shell type, or appliances. Exceptions to this are that the voltage between conductors may exceed 150 volts when supplying only (1) permanently connected appliances; (2) portable appliances of more than 1380 watts; and (3) portable motor-operated appliances of  $\frac{1}{4}$ -hp or greater rating. Therefore, the answer to the first part of your question would be "yes."

As to the service, presumably the supply you are referring to is a 120/240-volt 4-wire 3-phase delta system, which handles the 3-phase and single-phase loads. If such is the case, the load for the 40-kw

40,000

3-phase furnace would be:  $\frac{40,000}{240 \times 1.73} = 96$  amps. Not knowing the actual single-phase loads, the minimum demand would be calculated from Paragraph 230-71, Exception No. 1, which states: "For single-family residences with an initial load of 10 kw or more computed in accordance with Section 220-4, the service equipment shall have a



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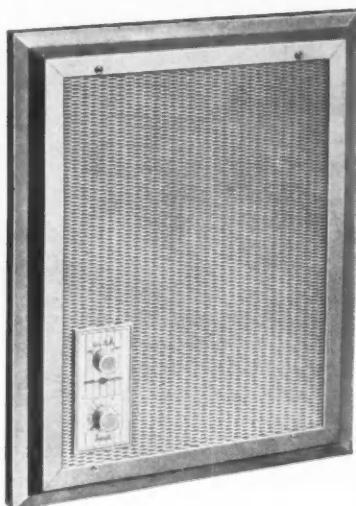
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rating of not less than 100 amps." As a result, the load for the two single-phase conductors can best be determined by adding the single-phase load (100 amps) and the 3-phase load (96 amps), which would total 196 amps for these two ungrounded leads. Thus, these two wires would have to be 3/0 RHW or THW or equivalent. For the high leg (96 amps), the logical size would be No. 2 RHW or THW. And generally, the neutral conductor could be No. 4 RHW, THW or bare. Applying Tables 4 and 5 of Chapter 9, the cross-sectional area of two 3/0, one No. 2 and one No. 4 (all based on RHW insulation thicknesses) is 1.197 sq in. This would require a 2-in. conduit. —J.C.H.

## Direct-Burial Cable Over 600 Volts

**Q.** *It is desired to light a high school baseball field using steel towers and a total of 120 1500-watt lamps. Underground primary distribution is to be used and will extend from a service pole with primary metering and switching, as well as fuse protection, to the various towers. At each tower the primary circuit is to be brought up in conduit to the transformer location from where the secondary circuits continue to the branch-circuit panel up by the lights. The system is to be supplied from a 4160Y/2400-volt system with multi-grounded neutral.*

*The questions are these: (1) May direct-burial cable be used? (2) May the cable be protected by creosoted planks on the underground primary distribution circuits? (3) What type of cable shall be used for the phase conductor, and what type for the neutral? (4) Shall a separate grounding conductor be installed from the service pole to each tower?—L.S.M.*

**A.** In Article 710, which deals with circuits and equipment operated at more than 600 volts, under Section 710-3 the following is recorded with an exception that would not apply to your question: "Wiring Methods. Circuit conductors shall be suitable for the voltage and the conditions under which they are installed. They shall be installed in rigid metal conduit, in raceways or ducts or as open runs of metal armored cable suitable for the use and purpose." You will

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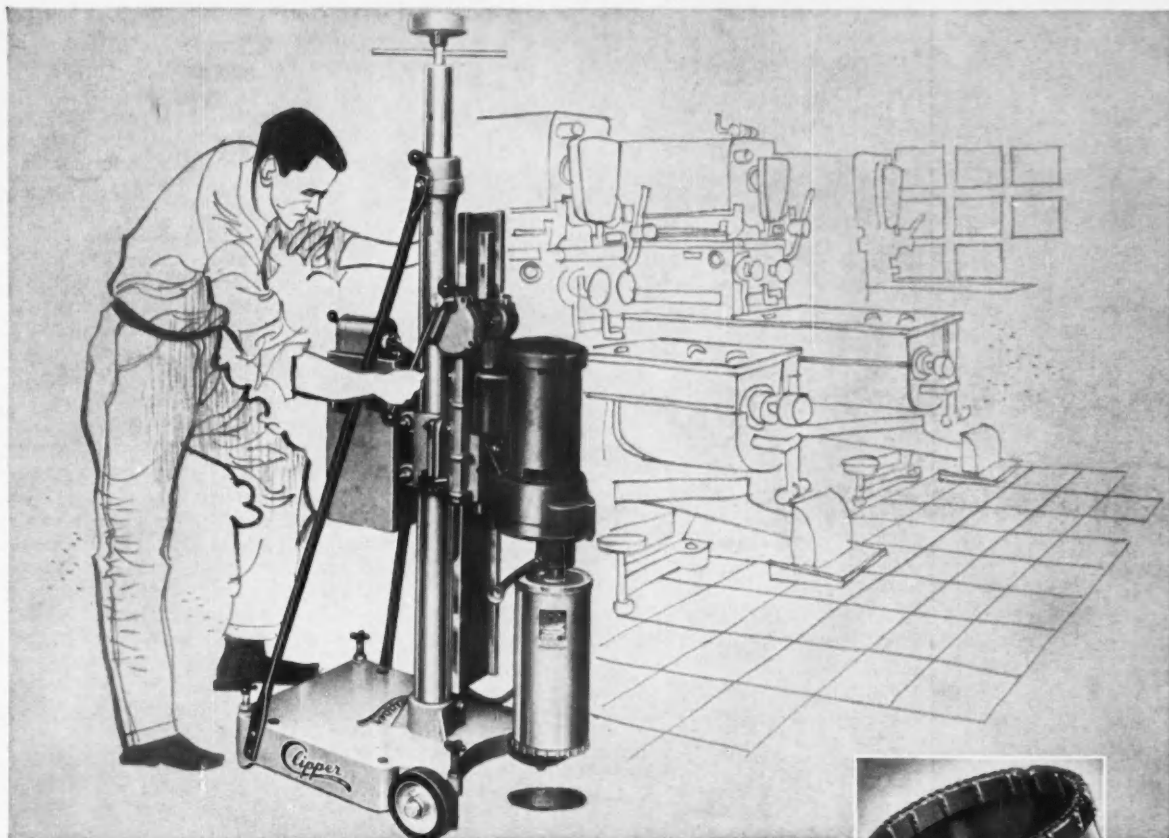
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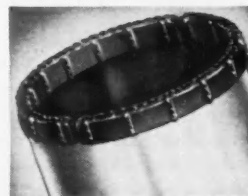
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note from the above that direct-burial cable is not mentioned. According to catalogs issued by wire manufacturers, they have direct-burial cable suitable for the voltage specified, and it is a well-known fact that many installations have been made. I am sure installations have been approved by inspection authorities by special permission and at the request of property owners and others involved. I have personal knowledge of one installation that is buried under the Tennessee River. This was a custom-made cable for a power distributor, and was certainly an expensive installation the same as any other method of crossing the river with a high-voltage supply line would have been.

The question of protecting buried cable with a creosoted plank, or otherwise, is one that is entirely left up to the inspection authority having jurisdiction over the installation. Existing conditions at the installation usually govern such rulings. As an example, the type of soil, the depth the cable is buried, location of trenches with reference to traffic, etc. If under a specific condition, where, in my opinion, circumstances were such that approval could be given to an installation of direct-burial cable above 600 volts, I would insist that the neutral conductor be a part of the cable assembly recommended for direct burial—or of equal insulation as the ungrounded conductors if not a part of the cable assembly.

Your last question concerns a separate grounding conductor from the service pole to each tower. The National Electrical Safety Code requires that exposed metal riser pipes containing supply conductors be grounded unless such conductors are covered with a metal sheath, or are themselves grounded. In your installation the metal towers, as well as other equipment, should be grounded in addition to the riser pipes. Grounding could be done by the use of grounding electrodes at each tower with all metal parts requiring grounding being bonded together and connected to the grounded conductor, or a separate grounding conductor could be used bonded to the neutral at the main service. There is a difference of opinion regarding which method should be used, and again I will say this is a question to be ruled on by the inspection authority having jurisdiction in the area where the installation is made.

A special technical subcommittee, chairmanned by O. K. Coleman, has



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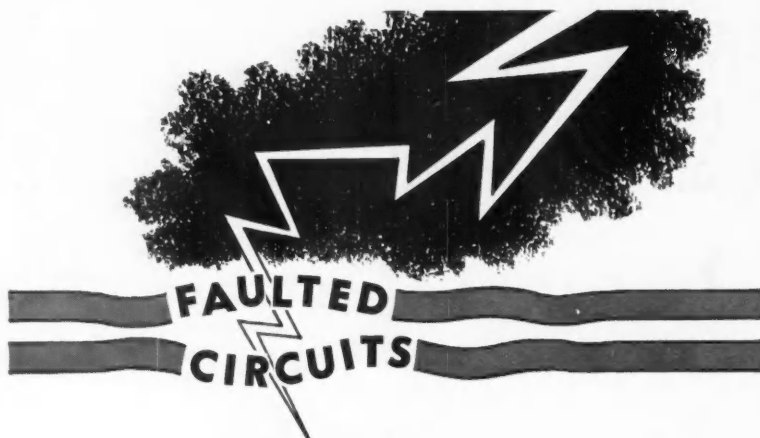
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been set up to make a study of underground installations. This committee was established in the latter part of 1961, and is now in the process of making their study. A member of this technical subcommittee has furnished me with a copy of some preliminary work that has already been done. Some of the questions raised by you are already under consideration. The others are being called to the committee's attention. With the new materials that are on the market today and the extensive use of underground wiring, the work of this subcommittee is certainly one of importance, especially to architects, engineers, contractors and inspectors. Until such time as a more complete set of rules is outlined in the code, the inspection authority having jurisdiction has the responsibility of making the necessary decisions for each individual installation.—R.E.W.

#### Use of Cable Trays

**Q.** In a feeder distribution system for an industrial plant, standard single-conductor, 600-volt conductors had been considered for installation in cable trays. In checking the 1959 NEC, we notice that no provisions have been made for this type of installation. A recent ruling by our local electrical inspector stated that such an installation would not be acceptable. It seemed that, from all practical purposes, especially from cost, that the inspector should have approved this proposed wiring system, and we feel that he was not in a position to make such a ruling. However, we did comply with his decision and recognized the cable trays only as a means of support for approved cable assemblies; but we feel that some further clarification should be made.—C.L.H.

**A.** It is true that the 1959 edition of the NEC does not recognize cable trays as a raceway for standard building wires. Such trays or troughs have always been considered as a means of support for conduits, cables or other forms of approved wiring methods. Because of this limited use, NEC authorities felt it unnecessary to include code provisions in the past. In spite of this, numerous installations have been made in the past few years where these cable trays contained standard Type T or Type R conductors. Little regard was



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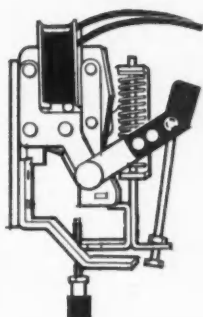
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#### ALARM SWITCH

When the breaker is tripped by overload or short circuit, the alarm switch closes to energize an indicating light or sound an alarm. Switches that open on tripping can also be supplied. They do not function on manual operation.

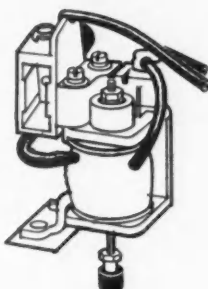
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#### UNDERVOLTAGE TRIP

A solenoid plunger actuates the trip mechanism to automatically trip the breaker when the line voltage drops below 40 to 60 percent of normal. Breaker cannot be reset until voltage returns to 80% of normal.

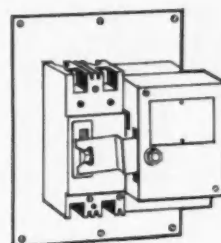
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#### SHUNT TRIP

The shunt trip is used for tripping the breaker from a remote point by a pushbutton or other device. Because the shunt trip coil does not have a continuous rating, a cut-off switch can be included to break the energizing current when the breaker opens.

4



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given to derating, spacing or conductor protection, with the result of several serious fires. Manufacturers of these cable supporting systems were equally as concerned with the problem as the inspectors. As a result, the 1962 edition of the code contains a new Article 318, titled "Continuous Rigid Cable Supports." This new code article substantiates the position of your electrical inspector in that recognition of "cable trays" is limited to a means of support for approved cable and raceway wiring methods. At the same time, Section 318-8 will allow factory-assembled multiple-conductor control or signal circuit and power cables especially approved for use in continuous rigid cable supports. Therefore, the only departure from the use of approved standard wiring methods in cable trays would be cables specially designed for the purpose. What these special cables will consist of, only time will tell. But the fact does remain that standard building wires do not constitute an approved wiring method in cable trays since the latter is not considered a raceway as would a totally enclosed metal wireway. It is quite obvious that totally enclosed metal wireways will better contain arcing line-to-ground faults within the raceway than if such faults would occur in a ventilated continuous cable support. This is the major reason something better than standard building wire should be placed in these trays.—J.C.H.

## Wiring in Metal Partitions

**Q.** Several manufacturers have metal wall panels that are designed for partition walls in buildings. Some of the panels have knockouts provided for electrical outlets.

Does the code recognize the hollow spaces in such panels as an approved raceway for electrical conductors?—H.H.B.

**A.** To my knowledge there is no reference made in the code for the use of such walls as raceways. In the panels that I have examined many are filled with an insulating material, and in order to use outlet boxes due to the thickness of the panels at switch and receptacle locations it is necessary that shallow boxes be used. In the installations that I am acquainted with, flexible metallic conduit was



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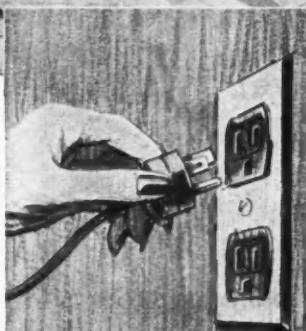
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used as the raceway inside the hollow spaces of the walls with shallow boxes at the outlets.

I have made inquiry of Underwriters' Laboratories requesting information as to whether or not the metal panels listed in the Building Materials List had been investigated for use as a wireway or raceway. In reply to this inquiry it was stated that the metal panels listed in the Building Materials List were investigated only for their performance as part of a fire-resistant assembly, and in the investigation made by Underwriters' Laboratories, such panels were not investigated as to their acceptability for use as raceways for electrical conductors. It was also stated that they had received inquiries from manufacturers as to whether or not Underwriters' Laboratories would undertake an investigation to determine the acceptability of the hollow space as a wireway or raceway. It is further stated that they expressed a willingness to undertake such an investigation; however, no listings for this use have been made.—R.E.W.

## Recognition of Non-Metallic Conduits

**Q.** Recently, statements have been made that the code now accepts non-metallic conduit. Is there a limited use for non-metallic conduit, and when will inspection authorities accept its use? —A.B.G.

**A.** The 1962 Code will have a new Article 347, titled "Rigid Non-Metallic Conduit." Section 347-1 is the description; Section 347-2 is the use permitted; Section 347-3 is the use prohibited; and Section 347-4, other articles. There are 12 items under Installations with a table, such table giving the maximum spacing between supports of conduit of sizes  $\frac{1}{2}$  in. through 6 in.

The 1962 Code was approved at the NFPA meeting held in Philadelphia in May, 1962. Printed copies of the code became available in September of this year, and generally speaking, inspection authorities accept installations according to the latest edition of the code soon after such codes are available. This would be a question to be answered by the inspection authority having jurisdiction over the installation involved.—R.E.W.



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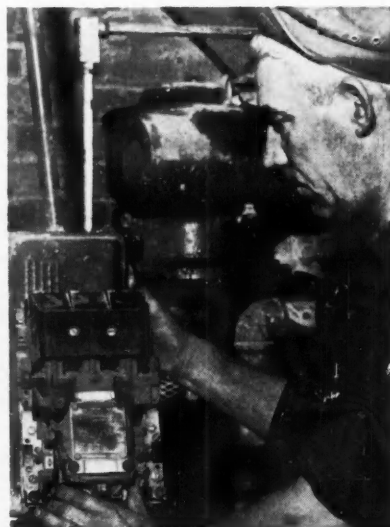
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This Westinghouse motor starter operated in an atmosphere of abrasive clay dust 14 times a minute, 24 hours a day, 365 days a year for *nine* years. That's 66,000,000 operations . . . and it still functions well. Scio Pottery Company engineers at Scio, Ohio, changed the motor size on their basic clay mixer, so they retired the Westinghouse starter that operated it. Instead of scrapping the starter, the chief electrician is counting on using it for emergency replacement!

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J-30342

**Westinghouse**



Scio's chief electrician Ross Huff inspects the size 4 starter which worked nine years in demanding, dirt-filled conditions. Reliability is one of the reasons why he insists on Westinghouse motor control.

# In the News

## Eastern Section IAEI Meeting

The Eastern Section of the International Association of Electrical Inspectors held its 38th annual meeting in the Mount Washington Hotel, Bretton Woods, N. H., September 10 through 12. An interesting 3-day program included addresses by industry authorities, IAEI officials and several NE Code Making Panel chairmen. Highlight of the meeting was the keen interest shown in the new requirements contained in the 1962 NEC. A copy of the new code was issued to each delegate. In addition, leading manufacturers displayed a variety of new electrical products.

At the meeting, C. L. Kelly, Sr., Bridgeport, Conn., was elected president of the Eastern Section for 1963, succeeding J. W. Mannix, Belmont, Mass. Other officers elected included V. E. Klein, Syracuse, N. Y., first vice president; G. B. Robertson, Philadelphia, Pa., second vice president; C. E. Schaad, New York City, third vice president; L. W. Turner, Scarsdale, N. Y., fourth vice president; and R. A. Rockford, New York City, secretary-treasurer.

E. E. Carlton, 1962 IAEI international president, San Francisco, Calif., delivered a major address to the convention in which he explained some of the significant IAEI activities which occurred during the past year. He pointed out that L. E. LaFehr, Alhambra, Calif., had been chosen as the managing director for IAEI by the association's executive council. To avoid any possible misunderstanding as to



**J. W. MANNIX** (L), Belmont, Mass., the 1962 IAEI Eastern Section president congratulates C. L. Kelly Sr., Bridgeport, Conn., on his election as the 1963 eastern president at the recent convention of the association held in Bretton Woods, N. H.

the newly created position, Carlton outlined the events leading up to the creation of the post of managing director and how the appointment was subsequently made. He stated that it was the aim of the executive council that the managing director would cooperate with other national trade associations and assist IAEI chapters as well as promote the objectives of the IAEI to all interested groups.

L. E. LaFehr addressed the delegates and offered to assist the members in any manner possible. He felt that his position, combined with that of the international secretary, would help to keep pace with the services required for the growing IAEI membership.

Percy Bugbee, NFPA general manager, outlined the role of his association in developing and promulgating practical standards to prevent fire losses in all fields of endeavor. He described how standards were developed and how code making panels were organized. He also added that many of the NFPA standards concerned electrical matters and that the various committees worked incessantly to keep the standards on a par with the latest technological advances. Bugbee thanked the IAEI for its excellent cooperation and contributions in helping to further the objectives of the NEC.

Frank Stetka, NFPA field engineer, explained his activities during the past year, stating that he had traveled extensively throughout the country to discuss the NEC with various electrical groups. He urged electrical inspectors and others to obtain copies of NFPA standards that are essential for

special occupancies, electrical effects, and conditions—such as Essential Hospital Electrical Service (NFPA 76); Code for Protection Against Lightning (NFPA 78) and Metal-Working Machine Tools (NFPA 79). Stetka also stated that where an individual is dissatisfied with any code rule he should follow the NEC procedures and offer a code revision backed up with sound reasons why a revision is necessary. Recommendations for code changes by individuals are given the same careful consideration as those submitted by organized electrical groups, he added.

H. H. Watson, chairman of CMP No. 2, reviewed the more important changes in Chapters 1 and 2 that appear in the 1962 NEC. R. L. Lloyd, chairman of CMP No. 4, explained the code changes in Chapter 3, while R. W. Osborn, chairman of CMP No. 11, covered the changes in Chapter 4.

A symposium on swimming pool wiring consisted of A. W. Smoot, research engineer, Underwriters' Laboratories Inc.; L. S. Inskip, protection engineer, Bell Telephone Laboratories; C. E. Schaad, State Superintendent of the New York Board of Fire Underwriters; and H. P. Michener, assistant engineering manager of NEMA. Michener started off the discussion by reviewing the provision of new Article 680, which concerns electrical wiring and equipment used in conjunction with swimming pools. Following this, Smoot described a number of tests made by UL to determine possible shock hazards in swimming pools. He stated that these tests were undertaken to assist in evaluating new code requirements

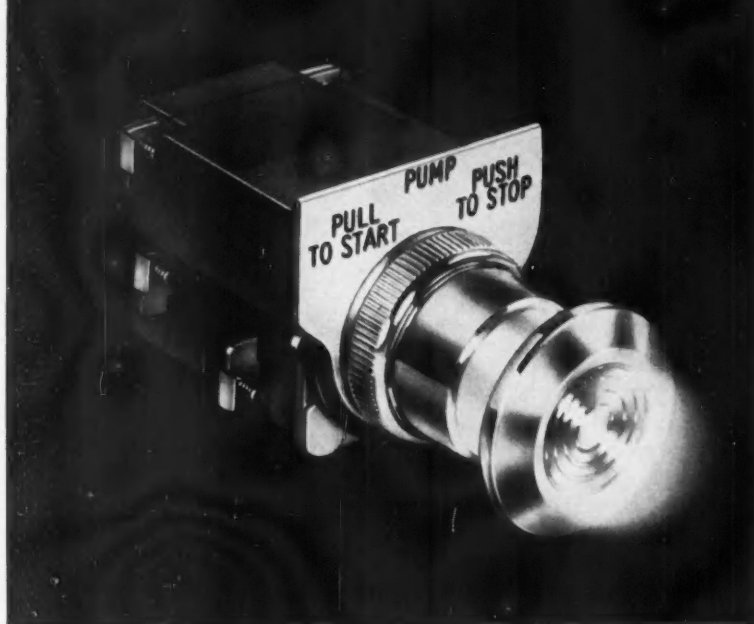


**KEY SPEAKERS** at the 38th annual IAEI Eastern Section meeting were L. E. LaFehr (L), IAEI managing director, Chicago, Ill.; and E. E. Carlton 1962 IAEI international president, San Francisco, Calif.



**1962 NEC CHANGES** provided the major interest at the 1962 IAEI Eastern Section meeting, attended by Duncan Graham (L), chief electrical inspector for Philadelphia; and Paul Duff, Philadelphia city inspector.

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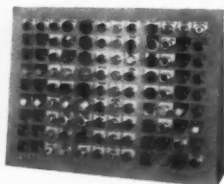


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**CHAPTER CHAIRMEN**, Thomas Green (L) of the Paul Revere Chapter and electrical inspector for Saugus, Mass., and Raymond Robideau of the Empire Chapter and electrical inspector for Ithaca, N. Y., compare notes after one of the code sessions at the recent IAEI Eastern Section convention.

and possible revisions to existing UL standards applicable to swimming pool electrical equipment. Inskip stressed the importance of a common ground to bond together all metallic components in and around swimming pools; and that by doing this, all such metallic parts will be held to the same potential. Schaad emphasized the importance of inspection and maintenance of pool electrical wiring and equipment, noting that even the best installations will require periodic tests and maintenance to assure continued safe installations.

Other interesting talks included "Many Switchgear Accidents Can Be Prevented," by William Wedendorf, manager of technical services, Mutual Boiler and Machinery Insurance Co.; "Current Limitation and Time-Delay Fuses on Distribution Systems," by M. R. Smith, chief applications engineer, Bussmann Manufacturing Division, McGraw Edison Co.; and "Aluminum Sheathed Cable," by P. H. Ware, manager of product development, Simplex Wire and Cable Co.

Several code clinics were held during the 3-day meeting with code discussions centering around existing and new code rules. Subjects such as explosion-proof seal-offs, overcurrent protection of motors, grounding-type receptacles and derating of conductors were discussed. The code panels consisted of members of NE code-making panels, who gave valuable background information in answering code questions.

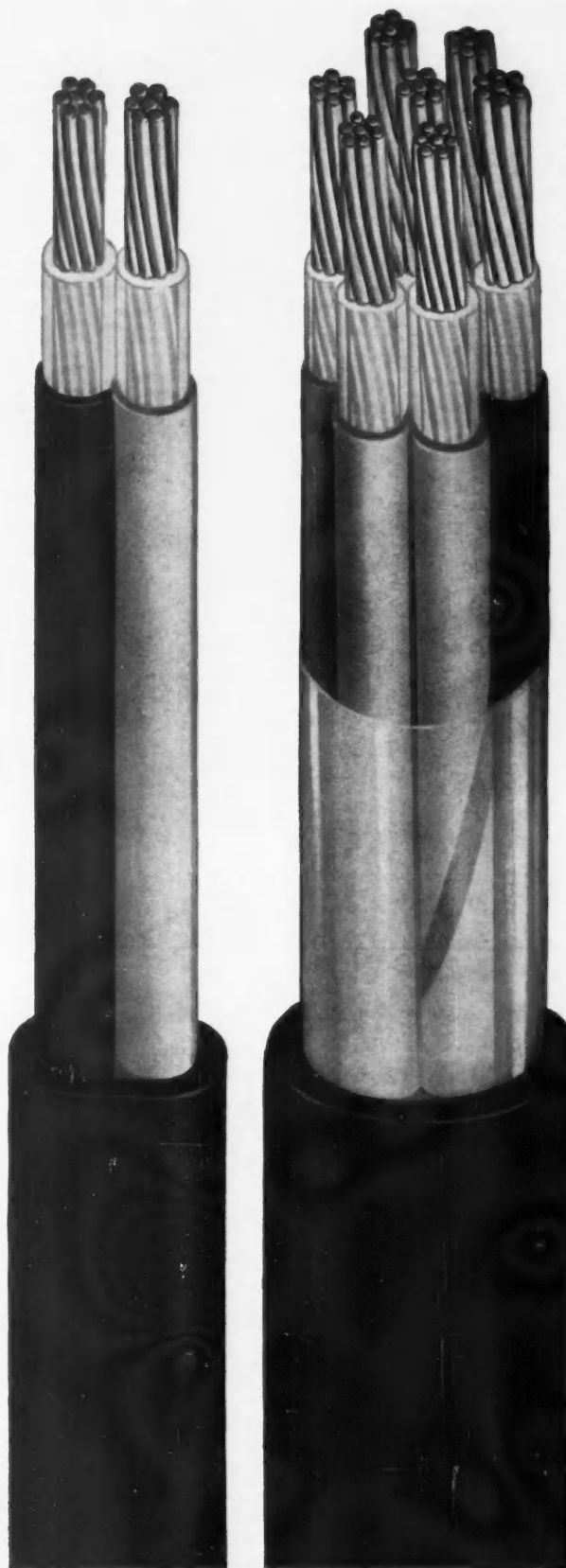
Approximately 500 delegates and guests attended the convention and technical sessions.



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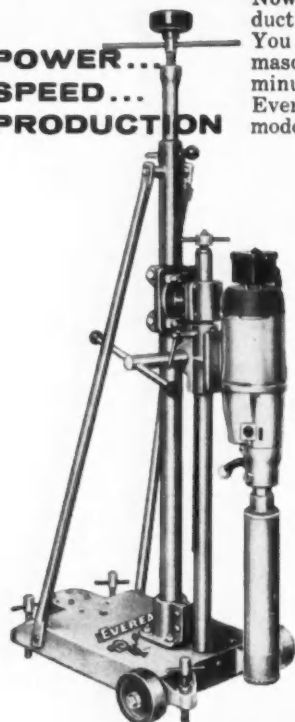
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**DISCUSSING CONVENTION EVENTS** at the 1962 IAEI Eastern Section meeting are (L) G. E. Riley, chairman of the License Board for DWSE&E, New York City; and V. E. Klein, chief electrical inspector for the Syracuse district of the NYBFU.

## Western Inspectors Meet in Chicago

The 58th annual meeting of the Western Section, International Association of Electrical Inspectors, drew a registration of more than 500 members and guests at the Morrison Hotel, Chicago, September 17-19. The 3-day program of this 18-state regional group highlighted the significant changes in the 1962 National Electrical Code, offered forum sessions on inspector field problems, and provided ample opportunity for delegates to visit product displays in an adjacent exhibit area.

Section President H. B. Love, Detroit, keyed the conference theme when he emphasized the importance of the electrical code and the electrical inspector to the safe installation and operation of electrical systems. Noting that inspectors have promulgated many existing electrical safety standards, he urged a continued educational program to improve inspector status in the community and electrical industry. Needed, among other things, is a prescribed course including the basic fundamental principles of electrical safety, he added. Michigan inspectors already have had several conferences on the "professional status" of inspectors, and the IAEI Educational Committee is now in the process of developing a certification program that will, in effect, raise the inspector to the level of an electrical safety engineer. Such a program, Love revealed, would establish definite character and educational and experience standards as prerequisites to IAEI Certification. He

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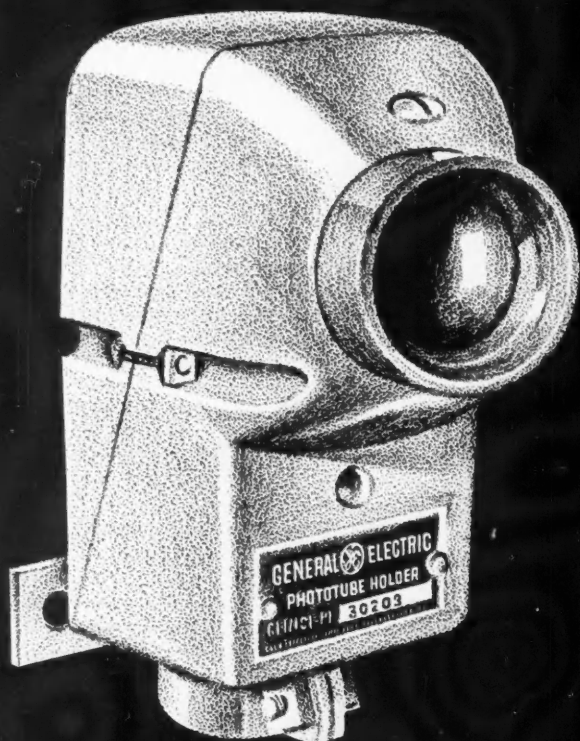


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**A CODE PROBLEM** is the topic of discussion between E. H. McNeill (L), electrical inspector, Manchester, Conn., and Harry Apraham, electrical inspector, West Hartford, Conn., during a recess at the recent IAEI Eastern Section convention.

urged immediate consideration of educational programs on a local Chapter level.

International President E. E. Carlton, Menlo Park, Calif., reported that all IAEI proposals, except one, submitted for inclusion in the 1962 NEC were accepted. That one proposal is now being considered as an interim amendment. Since all proposals are carefully screened by Code-Making Panels, it is important that qualified men be placed on such panels. To establish a talent pool for such appointments, Carlton suggested that all Section presidents designate two qualified persons to comprise such a "ready-reserve" talent group.

Mr. Carlton also reported on the IAEI Executive Council action at a regular and special meeting in Philadelphia in May relative to the appointment of a managing director. A subsequent special meeting of the Council in Chicago in August, reaffirmed the Philadelphia action, he added.

After being formally introduced to the Section, IAEI's new managing director, L. E. LaFehr, Chi-



**ELECTRICAL INSPECTORS** (L-R) L. P. Nordholm, Binghamton, N. Y.; W. R. Stone, Utica, N. Y.; and J. F. Meehan, New Haven, Conn., discuss mutual code problems at the 38th Annual Eastern IAEI meeting held in Bretton Woods, N. H.





**COMPARING NOTES** after a busy session at the 1962 IAEI Eastern Section meeting are (L) George Schardien, retired chief electrical inspector, Elizabeth, N. J., and John Fetty, chief electrical engineer for the District of Columbia.

cago, asked the support of all members in promulgating electrical code safety regulations. He specifically asked that factual field data be submitted to support IAEI code proposals or to refute other proposals which may be counter to IAEI safety principles. Noting that the 1962 NEC is much broader in scope, he revealed that the IAEI is now working on proposals for the 1965 Code.

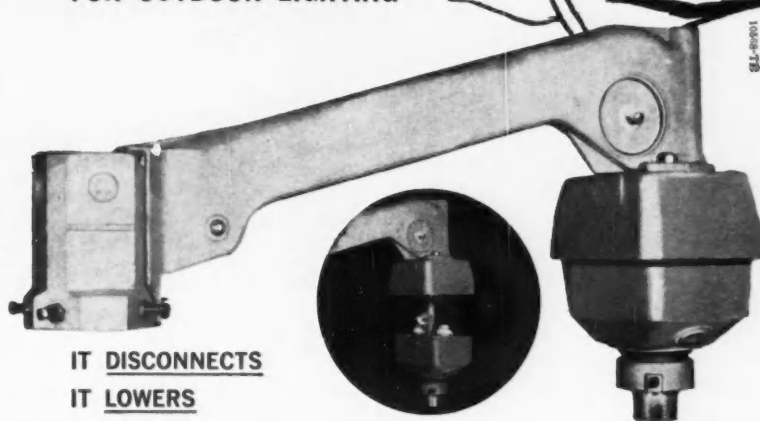
More than half of the 3-day agenda was devoted to panel and forum discussions of the new 1962 National Electrical Code and specific inspector field problems. Throughout the sessions, delegates made marginal notes in their new code books, filled notebooks with reference material, and used tape recorders to take verbatim comments and interpretations back home.

Changes in the 1962 NEC were reviewed and explained, section by section, by the following panel of code experts: Baron Whitaker, chairman, NFPA's NEC Correlating Committee; Frank Stetka, secretary of the Correlating Committee; R. L. Lloyd, chairman CMP No. 4; L. S. Inskip, chairman CMP No. 5; and H. H. Watson, chairman CMP No. 2. In addition, these engineers gave considerable insight into the "why" of a specific ruling and the "when and where" of necessary compromises needed to effect a workable rule. Throughout this session three facts were emphasized: the code is not intended as a design specification; the Underwriters' Laboratories "lists" equipment as meeting safety standards, but does not approve items; approval, as such, is in the hands of the inspector—the inspection authority.

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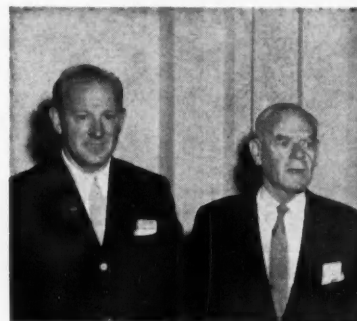


**PAUSING BETWEEN SESSIONS** at recent IAEI Eastern Section meeting are NYBFU electrical inspectors (L-R) Sol Leiman, Valley Stream, N. Y.; Stanley Horn, Rochester, N. Y.; and Francis Waters, Auburn, N. Y.

A film-talk by O. A. Cavanagh, Underwriters' Laboratories, Inc., Chicago, related the requirements and tests that must be met by equipment and materials to be used in hazardous locations.

Exchange of information was the rule during a full day's discussion of specific code interpretations and inspector field problems. Electrical inspectors from various sections of the Midwest comprised a panel to answer written and oral questions. On the panel were: S. M. Sanford, executive - secretary, Minnesota State Board of Electricity, Richfield, Minn.; R. B. Thomson, Missouri Inspection Bureau, Kansas City, Mo.; Eldon Patterson, Oklahoma Inspection Bureau, Oklahoma City, Okla.; C. B. Tressel, City Electrical Inspector, Canton, Ohio; E. J. Boyle, City Electrical Inspector, Chicago, Ill.; and J. E. Fisher, City Electrical Inspector, Elkhart, Ind.

A sincere desire to learn more about the code, to compare one's interpretation against those of others, and to get some measure of



**ATTENDING THE SESSIONS** at the 1962 IAEI Eastern Section convention were William Johnson, Johnson Electric Co., Newington, Conn., and Martin O'Rourke, electrical inspector, Waterbury, Conn.

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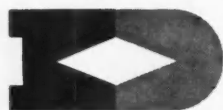
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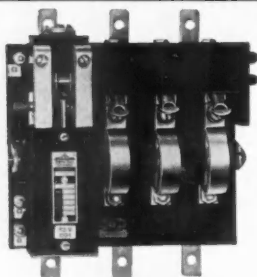
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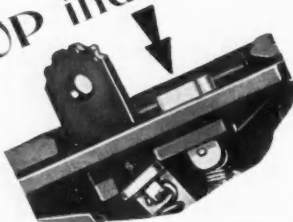
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**HEADING A DELEGATION** from the Paul Revere Chapter to the 1962 IAEI convention are (L-R) W. A. Fluhr, Brockton, Mass.; W. H. Pitts, electrical inspector, Quincy, Mass.; and F. R. White, electrical inspector, Brockton, Mass.

assurance that "I'm on the right track" was evident throughout the session. Questions ran the gamut of code regulations. Among the subjects discussed were: grounding, "grounded" and "grounding" conductors, color coding, feeder sizes, branch-circuit overcurrent protection, hazardous location requirements, double-insulation, 3-prong plugs and receptacles for grounding portable tools.

At the final business session, the following slate of Western Section officers was elected by a unanimous ballot. President—Eldon E. Patterson, Oklahoma City, Okla.; first vice president—C. B. Tressel, Canton, Ohio; second vice president—R. B. Thomson, Kansas City, Mo. D. M. Lines, Topeka, Kansas, was re-elected secretary-treasurer.

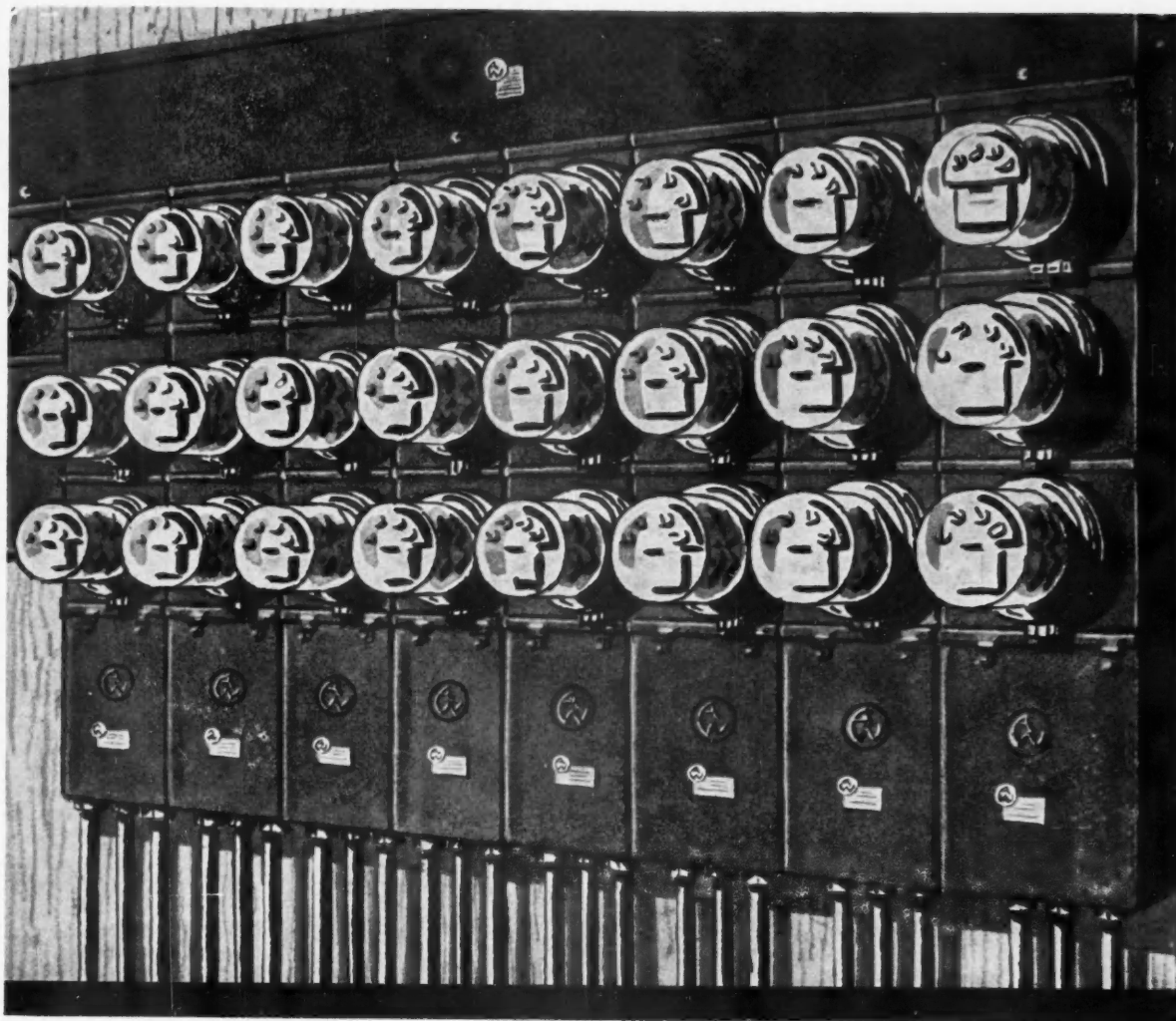
Elected to the Western Section Executive Committee were the following: S. M. Sanford, Richfield, Minn.; R. G. Pullen, Indianapolis, Ind.; E. J. Loesch, Cleveland Heights, Ohio; E. J. Morrison, Tulsa, Okla.; R. S. Davis, Detroit, Mich.; A. A. Sommer, Chicago, Ill.; and H. B. Love, Detroit.

Representing the Western Section on the IAEI Executive Council are: W. P. Hogan, Jr., Chicago, Ill.; Walter Stewart, St. Louis, Mo.; and D. M. Lines, Topeka, Kansas. Alternates are: J. E. Fisher, Elkhart, Ind., and H. B. Love, Detroit.

## EASA News

Sound management is the difference between success and failure in business, EASA President B. J. Horton told members of the international trade association recently. Executives of electrical apparatus service firms should review their "Three M's"—men, money and management, he said.





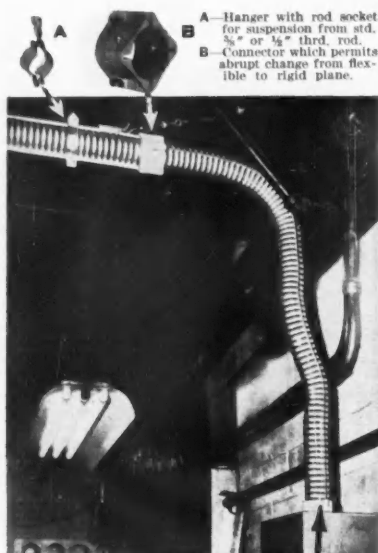
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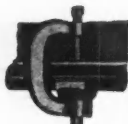
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"Countless operations, adequately supplied with men and money, have been spectacular in their failures. The reasons include injudicious use of capital, lax cost control, excessive (or inadequate) inventories; indiscriminate purchasing, poor selling techniques, failure to anticipate market trends, improper pricing and resistance to change," Mr. Horton said.

Too often the general manager of a motor shop is so busy doing the things that others should be doing for him he has no time to administer, the EASA president added.

Winding motors quickly is not recommended by an Ohio motor repair shop that says in its advertising it prefers to give each motor a double dipping and baking.

"We know from experience that given the care we give, windings last longer," an advertising piece from Lima Armature Works, Lima, Ohio, reads. Quoting EASA Rebuilding Standards, the advertisement states that insulation materials and methods "shall at least equal the manufacturer's." Ed Potter, an EASA director, is general manager of the firm.

Tom Paul, owner, Paul Electric Co., Sioux City, Iowa, was honored by members of Midwestern Chapter at a meeting in Minneapolis September 14-15 at Hotel Normandy. In addition to being named "EASAN of the MONTH" by the association, Mr. Paul was featured in a brochure of testimonial letters from industry leaders throughout the country.

A former director of the association and officer of Midwestern Chapter, Mr. Paul was praised for his devotion to the organization and his conscientious approach to responsibilities assigned him. "I never met a man who didn't like Tom Paul," one writer commented.

Damage claims by owners of electrical apparatus are verified with Polaroid pictures, thanks to the use of the camera owned by Orlando (Florida) Armature Works, Inc. "We take a photo of the damage from fire, flood, or other causes before pulling a motor off the job," reported J. H. Lott, owner. "We also take pictures of visible damage during disassembly." The pictures are often essential in collection, mounting claims, combined with the inevitable abuses, having caused insurance companies to take long, close looks at alleged damage.

The new president of the East

Side Safety Council, an industrial association organized in East St. Louis, Ill., for the improvement of plant safety practices, has elected as its president Sam Cavataio, shop supervisor of Illinois Electric Works.

The internationally known transformer rebuilding firm operated by William and Robert Ward, sons of the late EASA president, Robert E. Ward Sr., in Raleigh, N. C., has changed its name to Electric Motor & Transformer, Inc. The company had been known as Electric Motor & Repair Co.

A number of electrical apparatus service shops have been accepted by EASA as active members, including Klahr Electric of Albany, N. Y.; Andersen Electric Motor Co., Detroit, Mich.; Ervin Auto & Electric Service, Parsons, Kansas; Stewart's Electric Motors, Inc., Las Vegas, Nev.; Electric Motor Service, Madison, Wis.; Gulf Electroquip, Inc., Houston, Texas; and Langerstrom Electric Co., Oxnard, Calif.

A device that can clean most stator cores in less than two minutes has been built by Gene Sullivan, owner, E. R. Sullivan Co., Lynn, Mass. Combining a disc sander, hand grinder, impact wrench and the base of a pressing machine, Mr. Sullivan's invention is used regularly in his firm. In a test run, 24 stators, varying in size from 1/2 to 3 hp, were cleaned in 46 minutes, he reported.

Tom Hannon, Hanco, International, Canton, Ohio; William Thomas, The Travelers Insurance Co., Cleveland, Ohio; Charles B. Lehman, Delco Products, Dayton, Ohio; George Law, Reliance Electric Co., Cleveland, Ohio; M. D. Detweiler, Ford Motor Co., Dearborn, Mich.; and Robert Bressler, National Lead Co., Toledo, Ohio were the principal speakers at EASA's Northeastern Conference, held September 21-22, Cleveland, Ohio.

A search for a better location has led a Toledo motor service firm into the real estate business in a big way. Stanley Romanoff, president, Ontario Equipment Co., has been in the local news several times this year in connection with his industrial park development on a 22-acre tract he has acquired.

"From the time we went into the motor repair business in 1944," Mr. Romanoff said, "we have found our-



**OUTDOOR** lighting maintenance problems and solutions get airing by Charles Fogarty, Broadway Maintenance Corp., Newark, N. J., and Jack Siedman, Acme Floodlight Co., Newark, N. J., during post-session huddle at recent NALMCO convention in Chicago.

selves in the real estate business."  
"Our type of business required a certain kind of building. After several months' search, we found it. Hence, our first 'industrial development.'"

Since that time the firm has bought, improved and sold—the Romanoff formula—several buildings and tracts. The present project has been praised in the Toledo press, and Mr. Romanoff has been described as "a man who gets things done."

.....

Plans are underway for the 30th annual convention of the EASA, which will be held in Dallas, Texas, June 9-12, 1963.

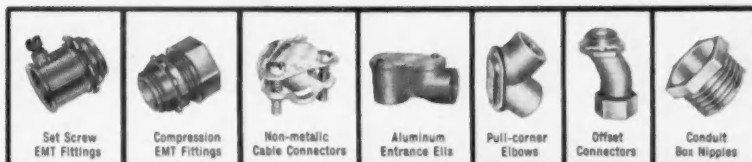
## Letters To The Editor

### WIRING SYSTEM

"Considering the various types of electrical equipment now available and on the market, I have been speculating why it would not be feasible for the manufacturers to bring out a composite baseboard wall unit which would include all electrical services for the room. That is, it would combine baseboard electrical heating and power and light outlets for all types of applications.

"The power channel could be equipped with three wires so that both 110-volt and 240-volt outlets could be served by it. A further refinement would be two wiring channels with one set of three wires each so that one 3-wire circuit could be switched and the other remain connected. The wiring channels could be supplied empty or wired,

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cast method. And to assure you of traditional Blackhawk quality, all fittings are pressure cast from durable Zamac No. 3. Lower prices, and a complete line to choose from... good reasons for buying the Bi-Line from Blackhawk.



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 For mounting Hangers on I-Beams. Mounts Minerallac hangers No. 0 to No. 6 on I-Beams without necessity of drilling holes. Has 1/4-20 tapped holes. Fits beam flanges up to 1/2" thick. Low cost.

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since continuous wiring at room corners would be more easily done during installation.

"Combining these wall units with a plug-in type of connection for the purpose of continuing the wiring services across and under doorways, we would have a complete room wiring device which would require only one set of connections per room.

"This type of unit could be designed for installation adjacent to and above the room baseboard, so that the baseboard would be continuous around the room. This would be an improvement in appearance and utility in my view.

"Compared to methods now in use this should provide a greatly simplified wiring system and would, I believe, reduce on-the-job installation costs." — Joseph A. Schaut, A.I.A., St. Mary's, Pa.

**TOOLS AND TECHNIQUES**

"Your recent article in *Electrical Construction and Maintenance* (March 1962) entitled, 'Tools and Techniques for Effective Maintenance' was quite interesting. We are particularly interested in the transistorized stethoscope (used to check motor bearings) that you referred to in the article. We would greatly appreciate any information that you may have available that would assist us in obtaining or fabricating a similar stethoscope. Efforts to locate an adequate transistorized stethoscope in this area have been fruitless."—A. B. Kaes, Monsanto Chemical Co., Port Plastics, Ohio.

For the benefit of our readers, the transistorized stethoscope is a sensitive listening device which may prove to be a versatile electrical maintenance tool. A portable unit, it consists of a set of earphones, a battery-powered transistorized amplifier and various detector probes.

It has been found to be quite useful when checking motor bearings or other apparatus with rotating parts. Also, it will detect unwanted vibrations in electrical equipment. In addition, it can be used to detect leaky air valves, etc.

When checking motor bearings, the operator wearing the earphones, places the probe on the motor bearing housing and listens for unusual sounds, such as grinding or pounding, which would indicate a failing bearing.

The stethoscope, called a model A Detecto-scope by the manufacturer, is available from: Valley Engineering Co., 15th St., Easton, Pa.

**NEW**



Here is a tool that should be in every line-man's and electrician's kit... the new Klein Pump Plier. Made in three sizes, 10 in., 12 in., and 16 in. It is adjustable... each size is suitable for many applications.

The jaws are locked into place for the desired sized opening by engaging a tongue in the proper groove. Jaws cannot slip even under heavy pressure. 10 in. and 12 in. available with or without yellow plastic handles. 16 in. supplied with yellow plastic handles.

Write for Bulletin 1261



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## DATES AHEAD

**National Electrical Contractors Assn.**—Minneapolis Auditorium, Minneapolis, Minn., October 9-13.

**Rocky Mountain Electrical League**—Fall convention, The Broadmoor, Colorado Springs, Colo., October 14-18.

**International Association of Electrical Inspectors—Southern Section**, Tutwiller Hotel, Birmingham, Ala., October 15-17; **Canadian Section**, Queen Elizabeth Hotel, Montreal, Can., November 1-2.

**Materials Handling in Canada Exposition**—Automotive Bldg., Exhibition Park, Toronto, Can., October 15-18.

**Florida Association of Electrical Contractors**—Annual conference (no trade show), Castaway's Motel, Daytona Beach, Fla., October 18-20.

**Electrical Manufacturers Trade Show**—Indiana State Fair Grounds, Indianapolis, Ind., October 23-25.

**National Electrical Manufacturers Assn.**—Annual meeting, Shoreham Hotel, Washington, D. C., week of November 12.

**Electrical & Home Appliance Show**—Balboa Park, San Diego, Calif., November 23-28.

**Building Research Institute**—Fall conference, Mayflower Hotel, Washington, D. C., November 27-29.

**Electrical Engineering Exposition**—Sponsored by AIEE, Coliseum, New York, N. Y., January 28-31, 1963.

**Plant Engineering and Maintenance Show**—McCormick Place Exposition Center, Chicago, Ill., January 28-31.

**American Institute of Electrical Engineers**—Winter general meeting, Statler-Hilton Hotel, New York, N. Y., January 31-February 5.

**16th International Heating & Air Conditioning Exposition**—Coliseum, New York, N. Y., February 11-14.

**Associated General Contractors of America**—44th annual convention, Americana Hotel, New York, N. Y., March 4-7.

**4th Southeastern Plant Engineering and Maintenance Exposition**—Merchandise Mart, Charlotte, N. C., March 5-7.

**Third Alabama Electrical and Electronics Exposition**—Municipal Auditorium, Birmingham, Ala., April 1-3.

**National Industrial Production Show of Canada**—Exhibition Park, Toronto, Ont., May 6-10.

**National Fire Protection Assn.**—Annual meeting, Hilton Hotel, Portland, Oregon, May 13-17.

**Electrical Apparatus Service Association**—Annual convention, Statler-Hilton Hotel, Dallas, Texas, June 9-12.

**National Electronics Conference**—McCormick Place, Chicago, Ill., October 28-30.

# McGILL

## TOGGLE SWITCHES

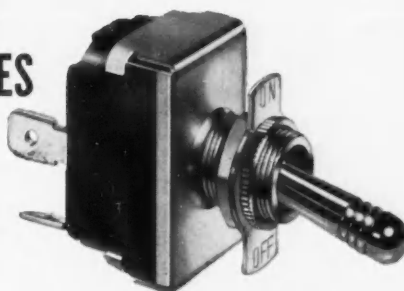
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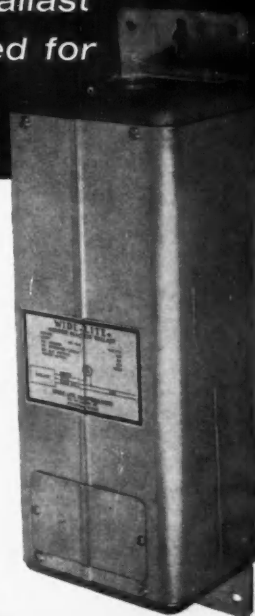
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## Among the Manufacturers

### Headquarters Announcements

A new Large Generator and Motor Dept. has been formed by the General Electric Co., Schenectady, N. Y. It combines the operations of the former Medium AC Motor and Generator Dept. and the Large Motor and Generator Dept. Olaf F. Veja has been named general manager.

Omaha Steel Works, Omaha, Neb., has announced the acquisition of the Brown Manufacturing Co., Woodbine, Iowa. W. D. Brown, president of the Woodbine firm, will remain as general manager.

Major Industries, Inc., Free-land, Pa., announced the purchase of the air ventilating division of Progress Mfg. Co., Inc., Philadelphia, Pa. Lester Benjamin has been named sales manager of this new subsidiary which will be known as the Progress Power Vent Corp.

Worthington Corp., Harrison, N. J.—Frank J. Nunlist, president; Walther H. Feldman, continuing as chief executive officer, was named chairman; LaMonte J. Belnap, chairman of the executive committee; Albert G. Mumma, director.

Sta-Warm Electric Co., Ravenna, Ohio—W. G. Jordan, president.

Westinghouse Electric Corp., Bloomfield, N. J.—Howard J. Thomas, marketing manager; Oscar Poulson, national accounts sales manager; Lamp Div.

California Resistor Corp., Santa Monica, Calif.—John E. Ryan, sales manager.

I-T-E Circuit Breaker Co., Philadelphia, Pa.—John R. Chamberlin, Jr., manager of Small Air Circuit Breaker Div.

Tork Time Controls, Inc., Mt. Vernon, N. Y.—Warren Peterson, director of sales engineering.

J. I. Case Co., Racine, Wis.—J. William Kelly, general parts manager; James L. Ketelsen, vice president-finance and treasurer.

Black and Decker Mfg. Co., Towson, Md.—Richard V. Dempster, director, Contract Div.

Marble Corp., Gladstone, Mich.—Leslie S. Bryant, general manager.

Wilbur B. Driver Co., Newark, N. J.—John R. Redmond, sales manager.

Kaiser Aluminum & Chemical Corp., Oakland, Calif.—Cornell C.

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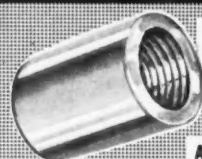
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Maier, manager, Electrical Products Div.

**Peschel Instruments Inc.**, Paterson, N. Y.—Robert A. Most, sales manager.

**Radiant Lamp Corp.**, Newark, N. J.—Chalmer J. Carothers, manager of marketing.

**Electro Consolidated Corp.**, Chicago, Ill.—Ronald J. Mott, vice president.

**Permacel**, New Brunswick, N. J.—Jerome Kronfeld, product manager.

**Pittsburgh Standard Conduit Co.**, Verona, Pa.—John A. Eitel, vice president.

**Toledo-Beaver Tools, Inc.**, Toledo, Ohio—Frank H. Orris, manager of field sales.

**Sylvania Electric Products Inc.**, Salem, Mass.—Peter Zitso, special products merchandising manager, Lighting Products Div.

### Regional Appointments

#### NEW ENGLAND

**General Electric Co.**: Richard W. Tolstrup, manager of Boston service shop in Medford.

**Anchor Mfg. Co.**: Paynter-Macpherson, Watertown, Mass., southeast New England sales representative for eastern Massachusetts and Rhode Island.

#### MIDDLE ATLANTIC

**Wheatland Electric Products Co.**: Samuel K. Solnek, Jr., Philadelphia, sales representative for eastern Pennsylvania, southern New Jersey and Delaware.

**Edwin F. Guth Co.**: Torrey A. Tellefsen, Nanuet, N. Y., factory representative for New York City, Long Island and Connecticut.

**General Electric Co.**: Theodore C. Ley, sales representative for Silicone Products Dept., located at Drexel Hill, Pa.

**Eagle Electric Mfg. Co., Inc.**: J. R. Shafnacker, district sales manager for middle Atlantic states.

#### SOUTH ATLANTIC

**Hoffman Bros. Drilling Co.**: Joseph B. Harper, manager of southeastern division with headquarters in College Park, Ga.

**Litecontrol Corp.**: Frank Weissman, Sarasota, Fla., district sales representative covering the west coast, central section (Orlando area) and the northeast section of Florida.

**Westinghouse Electric Corp.**: Merrill S. Sancraint, manager of



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easily  
repaired with  
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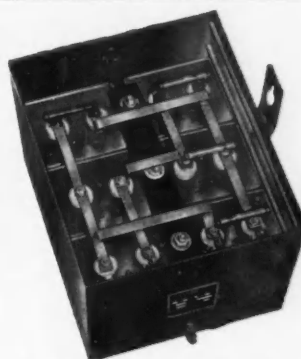
2¢ worth of LOCTITE sealant, "the Liquid Shim," restores bearing fits in electric motor end-bells without machining. Just a drop or two of LOCTITE sealant on bearing and housing does the job in minutes. Eliminates need for reboring, sleeves, shims, metallizing. Bearings mounted with sealant can be removed with ordinary bearing removal tools. Comes ready to use. No mixing.

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Motors and similar equipment in your plant use both kilowatts (working current) and kilovars (magnetizing current). The kilowatts you buy from your electric company. The kilovars you can best supply yourself with Sprague power factor correction

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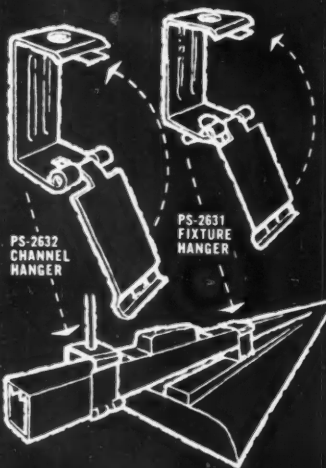


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southeastern sales region with offices in Atlanta, Ga.; Lamp Div. **Bailey Meter Co.:** S. G. Duke-low, regional manager with headquarters in Atlanta, Ga.

#### EAST CENTRAL

**Wheatland Electric Products Co.:** Morrison and Stewart Co., Birmingham, Ala., sales representative covering eastern Tennessee.

**Dayco Corp.:** C. Rodney Antrim, midwestern regional sales manager headquartered in Chicago, Ill.; Industrial Dept., Rubber Products Div.

**Allis-Chalmers Mfg. Co.:** R. A. Frazee, manager of Memphis district, Industries Group.

**Carpenter Steel Co.:** Robert K. Roesinger, branch manager in Cleveland.

**Westinghouse Electric Corp.:** Daniel R. Thomas, sales manager of Chicago district, Lamp Div.; Adolph Frankel, national accounts representative for central and midwestern sales regions with offices in Chicago, Lamp Div.

**Pyles Industries, Inc.:** Arthur Powers, Jr., branch manager of new central office in Chicago.

#### WEST CENTRAL

**Wheatland Electric Products Co.:** Duke-Philibert Co., New Orleans, sales representative covering Shreveport trading area; Hodges Co., Dallas, sales representative covering southern Texas.

**Allis-Chalmers Mfg. Co.:** Warren F. Spanutius, manager, industrial sales, Dallas district, Industries Group.

**Westinghouse Electric Corp.:** John D. Reddaway, southwestern regional manager, with headquarters in St. Louis, Residential Marketing Dept.

#### WEST

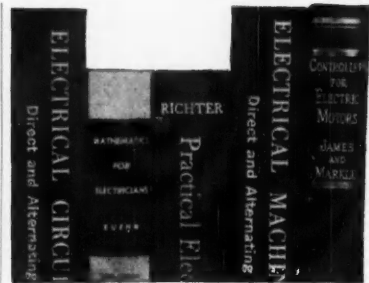
**General Electric Co.:** Everett L. Peterson, sales representative for Silicone Products Dept., located at Downey, Calif.

**Hitemp Wires Co.:** Fred W. Falck Co., La Jolla, Calif., sales representative in the San Diego area of southern California.

**J. I. Case Co.:** Harlan L. Hanson, manager of Oakland branch; Richard B. Hill, western industrial division sales manager.

**Murray Mfg. Corp.:** Howard H. Stevens, Southwestern Sales Co., Phoenix, Ariz., representative for Arizona and southeastern Nevada.

**Bailey Meter Co.:** N. P. Campbell, manager in San Francisco.



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## ELECTRICAL HAZARDS

[FROM PAGE 137]

conductors, the portion thus exposed should be protected by means of rubber and friction tape or equivalent protection. When it becomes necessary to carry cables some distance from the machine, the cables should be substantially supported overhead, if practical. If this cannot be done, and cables are laid on the floor or ground, they should be protected in such a manner that they will not be damaged, entangled, or interfere with safe passage.

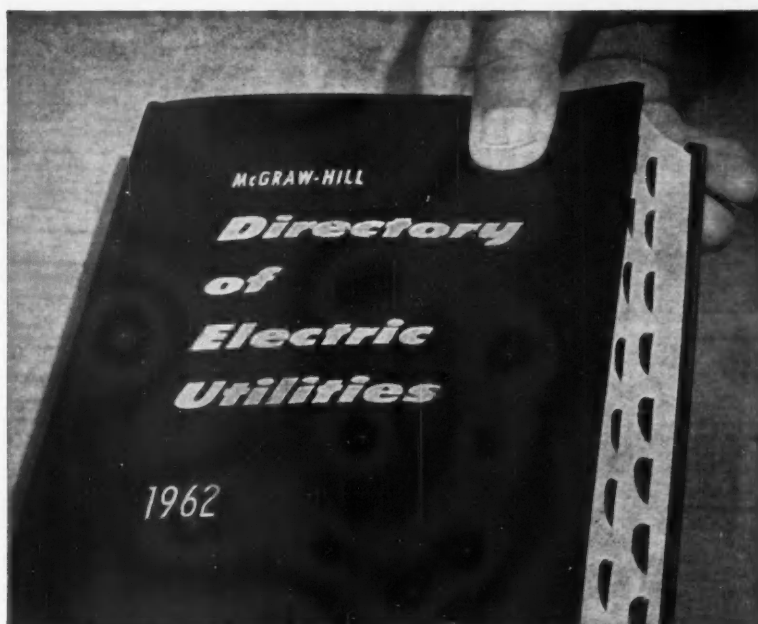
When artificial lighting is required for work in damp or wet places (such as tanks, boilers, condensers, similar metal containers) a 6-volt or 12-volt portable lighting system should be used. The use of low-voltage portable lighting equipment is an important safety measure for protection against electric shocks in such places.

In installations that would be otherwise difficult to safeguard, some protection can be obtained by the use of warning signs to call attention to the presence of electrical conductors.

Where electric conductors cross roads, even temporary ones, there may be adequate clearance provided by the elevation of the conductors. However, it is well to put signs at ground level at the approaches to the conductors so that a man operating equipment with high clearance will be warned of his approach to electrical wires.

Electrical failures cause numerous fires. The maintenance of insulation and the proper connection of all wiring protect against the loss of construction material by fires. To prevent overloading the electrical system, proper overcurrent devices should be installed.

The most important method for giving all workers protection against electric shock on the construction job is to have a continuous and thorough system for the maintenance of all electrical equipment and fixtures. This is particularly necessary on many types of construction jobs because of the handling of heavy material and equipment, the exposure to weather and the accelerated depreciation on work of this general type. A systematic inspection schedule and a maintenance record of each tool will help prevent accidents. Defective tools should be repaired.



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### ALUMINUM CONDUIT

[From PAGE 138]

crete. Can you give some simple rules to follow?

A. Yes, here is a simple statement, abundantly supported by research and by examination of aluminum conduit installations up to 25 years old:

Aluminum conduit can safely be enclosed in normal concrete and other common building materials without any surface preparation or protection, either above or below grade or water table.

**Q. But concrete is alkaline, and therefore supposed to be detrimental to aluminum. How do you reconcile this?**

A. Nature has provided this answer. During the setting period, the alkaline concrete reacts superficially with the oxide film on the aluminum conduit. This reaction forms a new complex chemical film which is self-inhibiting in that it limits subsequent corrosion in either dry or moist conditions. After the concrete has set, only a negligible amount of corrosion can occur.

**Q. What about calcium chloride in concrete?**

A. Alcoa recommends that aluminum conduit should not be buried in concrete containing soluble chlorides, whether from added calcium chloride, coral-bearing aggregates, unwashed beach sand, or from sea water, unless the aluminum conduit is first coated with a bitumastic or asphalt-base paint or similar and adequate protective coating. This precaution is not necessary where added chlorides are not present, whether the installation is above or below grade.

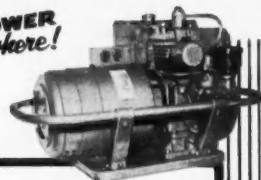
**Q. Why is this?**

A. Extensive and successful use of calcium chloride as an "accelerator" or "densifier" has not been without its hazards. The possibility of galvanic or electrolytic corrosion to encased metals may exist wherever calcium chloride is used as an additive to concrete. Deterioration of steel reinforcing, galvanized steel sheeting and piping, as well as aluminum, has been attributed to corrosive additives in conjunction with stray currents, saline waters and other factors.

**Q. Is this problem recognized?**

A. Yes. Many prominent architects, engineers and contractors specify that concrete structures shall be free of chloride-bearing

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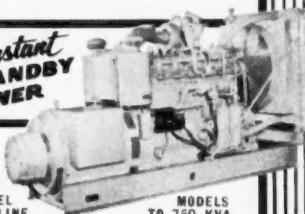


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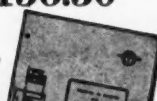
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additives. This precaution gives assurance against deterioration of the concrete itself as well as protection against corrosion of encased metals. Also, because of the critical possibility of corrosion to reinforcing tendons in pre-stressed concrete, a proposed revision to the ACI Building Code published by the American Concrete Institute would prohibit the addition of calcium chloride to any concrete that might be in contact with prestressing steel.

### Q. What is the alternative?

A. As a substitute for calcium chloride, many designers specify high-early-strength (Type III) portland cement or variations in the amount of water and/or normal (Type I) portland cement in the mix to accelerate setting. While possibly more expensive, these specifications give assurance against corrosion of encased metals.

### Q. Should aluminum conduit be buried in cinders?

A. Only if Section 346-3 of the National Electrical Code is observed. Cinders are corrosive to metals, and conduits buried in cinders should be encased in at least 2 in. of non-cinder concrete.

### Q. Can aluminum conduit be buried in soil without protection?

A. Yes, but we do not recommend it because some types of alkaline soil can corrode aluminum. Many soils also attack steel, so we think our suggestion applies to all conduits that must be buried in the ground. The surest protection is to trench and encase the conduits in grout. A coating of bitumastic or asphalt roofing paint will also provide adequate protection. Also, plastic tapes, which provide excellent protection, can be used.

### Q. Can I use a bare copper neutral wire in aluminum conduit?

A. Yes, but only if above ground and no moisture is present in the conduit to set up galvanic corrosion between the copper and the aluminum. If there is moisture, insulated neutrals should be used.

### Q. Is there a good "rule of thumb" about exposed aluminum conduit in chemically contaminated atmosphere?

A. Yes. If personnel is not required to wear masks while working in such an environment, it's an odds-on bet that aluminum conduit will perform satisfactorily. Even with sodium hydroxide, hydrochloric acid or hydrofluoric acid, direct splash or impingement is generally necessary for damage.

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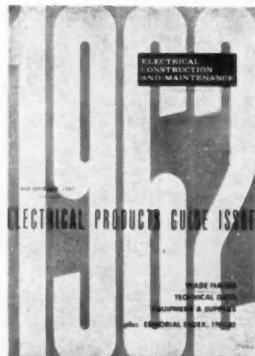
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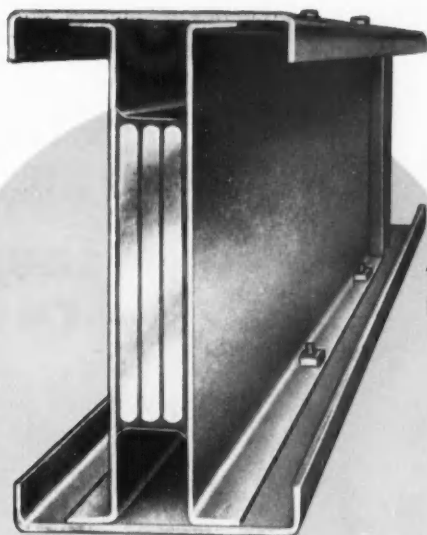
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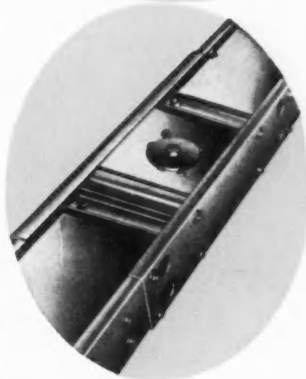
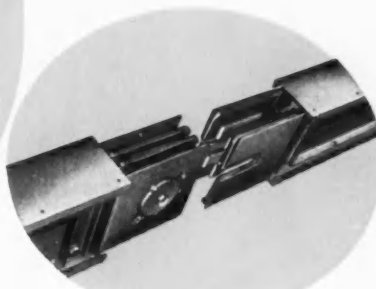
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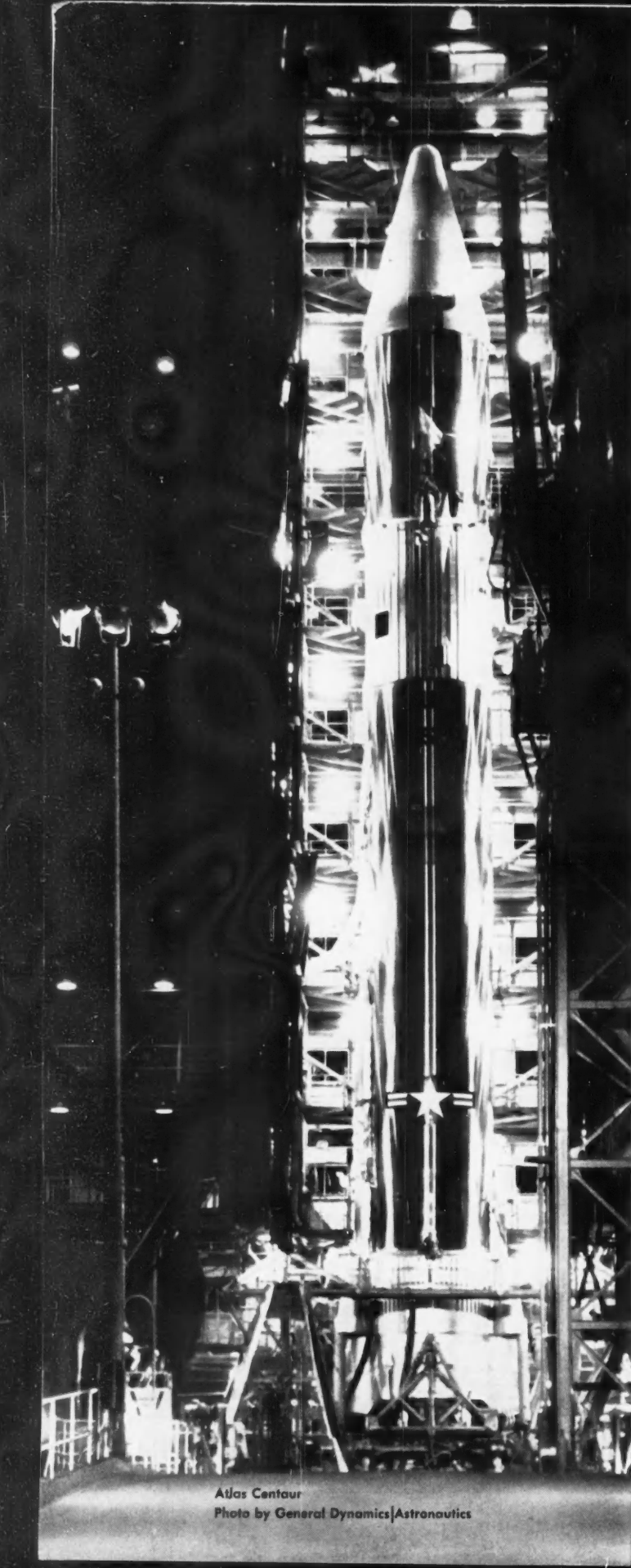
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